Traditional Knowledge Systems of India and Sri Lanka

Papers presented at the COMPAS Asian Regional Workshop on Traditional Knowledge Systems and their Current Relevance and Applications

3-5 July 2006, Bangalore

A. V. Balasubramanian and T. D. Nirmala Devi (eds)

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   (Intercultural and interscientific dialogue for strengthening the sciences of the original peoples in the Americas)
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Illustration on the cover

***Kalamkari* painting by artist C. Subramanian of Sri Kalahasthi, Andra Pradesh**

The cover depicts the story from our *Puranas* about the Neem tree. When the *Devas* and the *Asuras* (representing the divine and the demonic forces respectively) churned the ocean of milk, Lord *Dhanvanthri* (the patron saint of traditional medicine) appeared with a pot of *Amritha* (ambrosia). A few drops of this ambrosia dropped on the Earth and from these drops was born the Neem tree. It has been revered in our Tradition, as *Sarva Roga Nivarani* – the cure for all diseases. Even today it is widely used in traditional agriculture for crop protection and enrichment of soil.

PREFACE

The Compas programme for endogenous development has been in existence for over 10 years now, linking 26 partner organizations in 12 countries spread across Asia, Africa, Latin America and Europe. The common thread in the concerns and activities that link these organizations is the desire to comprehend, strengthen and enrich the traditional knowledge systems of their respective areas to meet today's challenges and requirements. In the context of Asia, in the last 10 years, Compas partners have been involved in wide ranging activities in the areas of healthcare, agriculture and veterinary care, to name just a few. The partners have been drawn from India, Sri Lanka, Indonesia and Nepal. The activities have also involved scholars and experts drawn from various branches of traditional knowledge systems. Several universities have also been interacting with the Compas partners in these efforts in all these locations. The Compas Asia programme has a formal collaboration in India with the Gandhigram Rural University in Tamil Nadu and the Rajiv Gandhi University for Health Sciences in Karnataka.

A series of regional workshops were organized by Compas partners during the year 2005 to review efforts in the area of traditional knowledge systems in Africa, Latin America and Europe. In continuation with these efforts, a three-day subregional workshop was organized by the Compas Asian partners on the traditional knowledge systems of India and Sri Lanka. The meeting was organized jointly with CIKS, Chennai and the Foundation for Revitalisation of Local Health Traditions, Bangalore. It was hosted by the National Institute for Advanced Studies at Bangalore.

The workshop was held with the objective of taking stock of varied efforts in the Asian region to study, comprehend and build on traditional knowledge systems in several areas. It attempted to explore the successes and failures of these studies as well as to explore the strategies for up scaling these efforts. The changes required at the policy and institutional levels for expanding these efforts were also deliberated upon. The present volume is meant to provide the reader with an overview of the material presented and discussed at the conference. We have presented in this volume the full text of the papers that were presented for discussion and, in a few cases where the full text is not currently available, abstracts have been presented. During the course of the meeting, the delegates were also involved in group discussions on focused themes with the objective of drawing up strategies and methods to influence policies. The results of these discussions have been presented as notes.

We are thankful to the large number of scientists, practitioners and policy-makers from various parts of India and Sri Lanka who participated in these meetings. The efforts of the Compas programme are taking place in the context of the present day scenario wherein there is widespread interest in various parts of the world in traditional knowledge systems, not only in terms of their content but also in terms of their world-view and underlying values. It is widely felt that these knowledge systems have an immense contribution to make in today's global search for alternatives that are sustainable and ecofriendly. Efforts of this nature are in progress in all parts of the developing world including Asia, Africa and Latin America. In this context, we believe that Asia has some features of specific interest and importance. Traditional knowledge in Africa and Latin America is by and large an oral tradition and does not contain texts that are written down and circulated. In the case of Asia, there is also a

rich and extensive body of classical literature in the form of a textual tradition that survives to this day. This offers unique and important possibilities in the global quest for strengthening and revitalization of traditional knowledge systems. In this respect, we believe that Asia has a rather unique and important role to play.

September 2006

A. V. Balasubramanian
Compas Asian Co-ordinator
Centre for Indian Knowledge Systems
Chennai

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ᵠ The full text of these papers are currently not available and hence the abstract alone has been presented here.

An Introduction to the Regional Workshop on Traditional Knowledge Systems and their Current Relevance and Applications

Background

The Asian region is one of the major world civilizations that can speak of a legacy of sciences, technologies, arts, crafts and knowledge systems going back as an unbroken tradition for a period of over thirty centuries. However, the current day situation in this region presents a confusing scenario with respect to the future of traditional knowledge systems. This scenario has the following prominent features.

- There is a large and overwhelming public presence of the institutions of modern science, technology, arts and knowledge systems as seen in all our educational institutions starting from the primary school level to higher studies in universities. The major resources and attention of the government and public bodies are towards supporting this large and growing presence of modern knowledge and their applications.
- While there is the existence of a large, rich and diverse body of knowledge and practices drawn from traditional sciences, technologies, arts and crafts as seen in varied areas like agriculture, natural resources management, healthcare, architecture and the fine and performing arts and crafts, most of these traditional knowledge systems receive very little or no policy and programme support from the state and public bodies.
- These traditions are rich and diverse, and in the Asian context, they seem to exist not just as folk/oral traditions but also as textual traditions, which means that there are classical texts on many subjects with their own theoretical foundations and world-views.
- There is also very little interaction between modern and indigenous practitioners. In a sense, they run parallel to each other – maintaining a distance without constructive interaction.
- This situation is also aggravated by the fact that the content and method of indigenous knowledge systems is not articulated in terms of its methodology, epistemology etc. in a manner that is comprehensible to the scholar or scientist with modern training.

Emerging scenario

In recent years, there has been a strong revival of interest and efforts relating to the contemporary application of traditional knowledge systems. Some reasons for this interest may be spelt out as follows:

- There is growing critique of the modern mainstream monoculture because of a feeling that while a tremendous amount was promised and expected what it has delivered is not commensurate with the expectations and investments in this area.

- At present, this critique is not limited only to the content of modern knowledge systems but there is also intense questioning regarding the limitations of the reductionist/mechanistic framework that is at the foundation of this system and also the claims of this system of having universal application and significance.
- There is a slow resurgence of interest in various branches of traditional knowledge systems like health, agriculture, metallurgy, arts, crafts, architecture and mathematics from the point of view of their contemporary relevance and rich applications.
- There is deep concern about the loss and erosion of cultural diversity and a growing realization of the importance of "traditional ways of knowing and studying nature".
- In the last couple of decades, there has also been an emergence of significant new technology particularly with respect to the recording and transmission of information as well as in communications that has large implications for knowledge systems. There is also an atmosphere of increasing commerce and a crumbling of trade barriers between various regions, leading to a scenario of globalization that offers a lot of possibilities but also carries with it risks in the context of traditional knowledge systems. This atmosphere also lends a certain urgency to the proposed exercise.

Context of the meeting

It has two contexts as outlined below

Starting from the 1970s onwards, there have been a series of efforts that have tried to change the characteristics of science and technology in the context of development in India and other developing countries. Earlier efforts were related to the emergence of rural/appropriate technologies that were considered more suited to the Asian context. There was also a move towards a democratization of science, which saw the rise of a large number of "peoples' science movements". Some of these efforts and movements also drew inspiration from indigenous knowledge systems. In the period from 1993 to 2000, there were three Congresses of Traditional Sciences and Technologies organized in Mumbai, Chennai and Varanasi led by the PPST Foundation, involving a large number of NGOs, research institutes, academics and government agencies. There were also a large number of efforts made to document and study traditional knowledge in varied areas. For example, in the area of agriculture this is continuing through the publication of HONEY BEE launched by Professor Anil Gupta in Ahmedabad and, subsequently, the ICAR (Indian Council for Agricultural Research) also launched a mission mode project for documentation of indigenous knowledge of agriculture.

Secondly, there is a 10-year effort for promoting endogenous development called Compas. It consists of a network of individuals, non-profit and community-based agencies and researchers located in universities and other institutions spread across 12 countries in Asia, Africa, Latin America and Europe. The common thread of concern and interest that connects this network is the appreciation of indigenous knowledge systems, their epistemologies and their possibilities of contemporary application. For the past 10 years, the Compas partners have been engaged in various

activities including documentation; testing and validation; propagation through training programmes and trainers' training programmes; interaction with universities and researchers and, to some extent, engagement with the larger society and policy-makers; interaction with government and local bodies and networking at the regional and international level. The Compas Asia programme has nine partners who are active in India and Sri Lanka along with two universities with whom memoranda of agreement have been signed and also includes independent researchers and scholars who are associated with the programme. The Asian Compas network is implementing activities related to field extension, training, documentation and scientific research on various aspects of traditional knowledge like conservation of indigenous varieties of seeds, organic packages for crop cultivation built on traditional systems of agriculture, research on Vrkshayurveda (traditional Indian plant science), ethnoveterinary practices, studies on traditional systems of healthcare including intercultural research on malaria, traditional bonesetting practices, treatment of snakebites, and researches into the Vaastu tradition of Sri Lanka.

A series of regional workshops have already been held to review efforts in the area of traditional knowledge systems in Africa, Latin America and Europe in 2006. It is expected that in October 2006 all these regional efforts will feed into an international workshop that will take place in Geneva in Switzerland. This Asian workshop was held to share the experiences and perspectives of Compas partners and also to interact with researchers and activists outside of the Compas programme who are exploring the contemporary relevance of indigenous knowledge systems.

Objectives of the workshop

- To take stock of varied efforts in the Asian region, to study, comprehend and build traditional knowledge systems in varied areas.
- To make an assessment of the successes and failures of these efforts as well as to explore strategies to upscale these efforts
- To explore the possibilities and problems of dialogues and the changes required at the policy and institutional level for expanding these efforts.
- To comprehend in detail the nature of indigenous knowledge systems including the manner in which knowledge is acquired, tested, developed and propagated.

Participants

Representatives from NGOs; researchers, academics and institutions involved in the study of the application of IK and persons involved with policy-making and governmental development programs. This meeting was limited to participants from India and Sri Lanka along with a couple of representatives from the Compas International Co-ordination Team in the Netherlands.

Programme Schedule

Compas Asian Regional Meeting on Traditional Knowledge

(3rd, 4th and 5th July 2006)

Day One : 3rd July (Monday)

Session I – Inaugural Session

- Welcome address (Mr. Darshan Shankar, Foundation for Revitalisation of Local Health Traditions, Bangalore)
- Overview of the workshop, its objectives and expected outputs (Mr. A.V. Balasubramanian, Centre for Indian Knowledge Systems, Chennai)
- Inaugural address (Dr. B.V. Sreekantan, National Institute of Advanced Studies, Bangalore)
- Knowledge and Sciences in the Global Context: Contradictions, Competition, Coexistence, Complementarity, Coevolution (Mr. Bertus Haverkort, Compas International Programme, The Netherlands).

Session II – Traditional Knowledge in Agriculture and Natural Resources Management

A. Agronomy

Chairperson and keynote address – Utilizing Traditional Knowledge in Agriculture (Dr. Y.L. Nene, Asian Agri-History Foundation, Hyderabad)

- *Nawakekulam* – A Traditional Agricultural Practice of Sri Lanka (Ms. Malkanthi Gunaratne, ECO, Sri Lanka)
- Documentation and Validation of Traditional Agricultural Practices (Dr. T.T. Ranganathan, Faculty of Agriculture & Animal Husbandry, Gandhigram Rural University, Gandhigram, Tamil Nadu)
- Traditional Agricultural Practices for Crop Protection – Testing and Validation (Ms. R. Sridevi and Mrs. Subhashini Sridhar, Centre for Indian Knowledge Systems, Sirkazhi & Chennai)
- Endogenous Development in Tribal Agriculture (Mr. K.J.N. Gowtham Shankar, Integrated Development through Environmental Awakening, Visakapatinam, Andhra Pradesh)
- Indigenous Agronomy Practices in Paddy Cultivation (Mr. K.A. Jayasinghe Perera, Future in Our Hands, Badulla, Sri Lanka)

B. Livestock and Veterinary Sciences

Chairperson: Prof. Sarat Bandara, University of Perediniya, Sri Lanka

- Documentation and Assessment of Ethnoveterinary Practices from an Ayurvedic Viewpoint (Dr. M.N. Balakrishnan Nair, Foundation for Revitalisation of Local Health Traditions, Bangalore)
- *Punyakoti* Test – An Ancient Egyptian Test (2200 BC) Extended to Diagnose Pregnancy in Cattle (Dr. T. Veena Ganesaiah, Veterinary College, Bangalore)
- Promotion of Ethnoveterinary Medicine in Dakshina Kannada District, Karnataka (Mr. G. Hariramamoorthy, Foundation for Revitalisation of Local Health Traditions, Bangalore)
- An Initiative towards the Conservation and Development of Indian Cattle Breeds (Mr. V.K. Aruna Kumara, Krishi Prayoga Pariwara, Shimoga, Karnataka)
- Traditional Veterinary Knowledge of Sri Lanka (Mr. K.A.J. Kahandawa, Future In Our Hands, Badulla, Sri Lanka)
- Towards A Pastoral Policy: For Protection of Pastoralists' Rights & for Conservation of Local Animal Breeds (Mr. P. Vivekanandan, SEVA, Madurai, Tamil Nadu)

Day Two – 4th July (Tuesday)

C. Traditional Methods of Weather Forecasting

- Testing of Traditional Methods of Weather Forecasting in Gujarat Using the Participatory Approach (Dr. P.R. Kanani, Associate Professor, Dept. of Extension, Gujarat Agricultural University)

Session III - Traditional Healthcare Methods

Chairperson: Mr. K.A.J. Kahandawa, Future in Our Hands, Badulla, Srilanka

- Reclamation of Traditional Knowledge on Snake Bite Treatment (Mr. Nimal Hewanila, Friends of Lanka, Kegalle, Sri Lanka)
- Traditional Orthopaedic Practices of Southern India - A Pilot Study (Dr. P.M. Unnikrishnan, Foundation for Revitalisation of Local Health Traditions, Bangalore)
- Advocacy for Recognition of the Dai (India's Traditional Midwife) – A Case Presentation by CHETNA (Vaidya Smita Bajpai, CHETNA, Ahmedabad)
- Traditional Medicine and Food Today (Mr. Jayasinghe, Future In Our Hands, Badulla, Sri Lanka)
- Conflict, Coexistence and Translation: The Question of Innovation in Contemporary Traditional Medicine (Dr. Harish Naraindas, Centre for the Study of Social Systems, Jawaharlal Nehru University, New Delhi)

Session IV – Discussion on Policy Issues Working in Smaller Groups

- Group I - University teaching and research
- Group II - Generation and validation of traditional knowledge
- Group III – Upscaling and translating endogenous development (ED) into action
- Group IV – Advocacy forum
- Cultural programme in the evening

Day Three – 5th July (Wednesday)

Session V - Methodology of Traditional Sciences and Technologies

Chairperson: Dr. Harish Naraindas, Jawaharlal Nehru University, New Delhi

Keynote address: Is There an Indian Way of Doing Science?
(Mr. A.V. Balasubramanian, Centre for Indian Knowledge Systems, Chennai)

1. How should research on traditional medicine be carried out – from critique to construction?
   Presentations :

- Research in Ayurveda (Dr. Rama Jayasundar, All India Institute of Medical Sciences, New Delhi and Sri Jayendra Saraswathi College of Ayurveda, Chennai.)
- Methodological Rigour in Knowledge Building – Ayurveda and the Scientific Challenge (Dr. Ram Manohar, Arya Vaidya Pharmacy Trust, Coimbatore)
- Traditional Knowledge Guided Research & Standardization of Traditional Medicines (Dr. Padma Venkatasubramanian and Dr. P.M. Unnikrishnan, Foundation for Revitalisation of Local Health Traditions, Bangalore)

2. Traditional understanding of agriculture and life sciences
   Presentations :

- Indigenous Methods in Sri Lankan Agriculture: Beliefs, Mysteries, Myths or Science (Prof. J.M.R Sarat Bandara, Peredeniya University, Sri Lanka)
- Universities: From Assessment of Traditional Knowledge to Intra- and Intercultural Dialogue and Coevolution (Mr. Coen Reijntjes, Compas International Group, the Netherlands)

3. Tanks and Anicuts of South India: Examples of an Alternative Science of Engineering (Dr. Chitra Krishnan, Dr. Srinivas V. Veeravalli, Dept. of Applied Mechanics, IIT, New Delhi)
4. Concepts and Principles used in Traditional Houses and their Modern Adaptations in Sri Lanka (Prof. Nimal De Silva, University of Moratuwa, Colombo, Srilanka)
5. New physics and Old Sciences (Dr. Ananda Wood, Pune)

Session VI – Creating an Enabling Policy Environment for Strengthening Traditional Knowledge Systems

Chairperson – A.V. Balasubramanian, Centre for Indian Knowledge Systems, Chennai

- Keynote address by Dr. P.M. Bhargava (Vice Chairperson, Knowledge Commission, Government of India)
- Presentations from participants, drawing upon the deliberations of the various sessions

1. Mr. K.A.J. Kahandawa, Future In Our Hands, Badulla, Sri Lanka
2. Prof. Sarat Bandara, Professor, University of Perediniya, Sri Lanka
3. Mr. G. Raju, Executive Director, Gram Mooligai Company Limited, Bangalore
4. Prof. Lakshmi Thattachar, Director, Veda Vijnana Vikas Prathisthanam, Mysore
5. Mr. Bertus Haverkort, Compas International Group, the Netherlands.

Conference Papers

Knowledge and Sciences in the Global Context:
Contradictions, Competition, Coexistence, Complementarity, Coevolution

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Abstract

This paper shares the experiences of a lively international movement to revitalise local knowledge and culture. Through its action research in Asia, Africa and Latin America, the partners in Compas have learned that even with the immense diversity in the ways local knowledge is phrased and expressed, a common feature is represented by conceiving life in terms of three interrelated and inseparable domains: the natural world, the social world and the spiritual world. None of these domains is existing in isolation. In many traditional ways of knowing, a notion of unity exists according to which the natural, social and spiritual worlds are considered to be inseparable and integrated.

Compas takes as the definition of science: The body of knowledge and its classification under a theoretical framework. It includes the complex of producing knowledge based on a specific world-view and on assumptions, general principles, theories and methodologies about which a specific community has reached consensus. The knowledge acquired and the resulting science is always limited and subject to modification in the light of new data and information.

From this definition, it can be concluded that there are many different coexisting sciences and numerous ways of knowing. Next to the academically established and globally dominant sciences (with an assumed western origin), there are sciences rooted in other cultures. Plurality of world-views can lead to a plurality of sciences. The differences in ontological positions and in the sources of knowing determine the degree of compatibility and or complementarity of sciences. The insight is emerging to look at world-views, sciences and values not as universal but as expressions of a pluralist reality. In this view, intercultural dialogues, mutual learning and coevolution of the diversity of sciences are important. But, how can we form rules of the game for understanding and exchange between individual knowledge systems? To what extent can we expect contradiction, synergy or complementarity between different forms of knowledge? How can we make exchange between e.g. Maya knowledge, Shona knowledge, Hindu and Buddhist knowledge, European and global knowledge beneficial for the participants?

I suggest two conditions for intercultural dialogues: ***Acceptance of pluralism and symmetry.*** *Pluralism in the ways of knowing leads to a diversity of sciences. Symmetry in power and in the contributions of the criteria for knowing will prevent a dominant system from determining the rules of the game. Local knowledge should not be assessed by the criteria and methods used by global science, or the other way around. For an inter-scientific discussion it is important to have a formulation of the characteristics of different ways of knowing (in terms of the ontology, sources of the knowledge and epistemology) and a self assessment of the relative strengths and weaknesses of each knowledge. This could coincide with an assessment of the power relation between the systems involved. Intra-scientific dialogue and revitalization of indigenous knowledge is a precondition for inter-scientific dialogues. The Compas programme has started to formulate the most striking characteristics of the paradigms and epistemologies of sciences in Africa, the Andes, India and Europe. Compas wants to*

provide a platform for inter-scientific dialogue that can contribute to a coevolution of sciences. In this process, each science involved is stimulated to evolve (to develop and improve their methods and theories) on the basis of their own dynamics as well as on the basis of interaction with other systems of knowing.

The paper shares the experiences of a lively international movement to revitalize local knowledge and culture.

Through its action research in Asia, Africa and Latin America, the partners in Compas have learned that even with the immense diversity in the ways local knowledge is phrased and expressed, a common feature of many traditional ways of knowing is the notion of unity according to which the natural, social and spiritual worlds are considered to be inseparable and integrated.

Compas takes as the definition of science: The body of knowledge and its classification under a theoretical framework. It includes the complex of producing knowledge based on a specific world-view and on assumptions, general principles, theories and methodologies about which a specific community has reached consensus.

The knowledge acquired and the resulting science is a social construction and always limited and subject to modification in the light of new data and information. From this definition, it can be concluded that there are many different coexisting sciences and numerous ways of knowing. Next to the academically established and globally dominant sciences (with an assumed western origin), there are sciences rooted in other cultures. Plurality of world-views can lead to a plurality of sciences. The differences in ontological positions and in the sources of knowing determine the degree of contradiction, compatibility and or complementarity of sciences.

The insight is emerging that we should look at world-views, sciences and values not as universal, but as expressions of a pluralist reality. In this view, inter-cultural dialogues, mutual learning and coevolution of the diversity of sciences are important. But then, how can we form rules for understanding and exchange between individual knowledge systems? To what extent can we expect contradictions, synergy or complementarity between different forms of knowledge? How can we make an exchange between, for example, Maya knowledge, Shona knowledge, Hindu and Buddhist knowledge, European and global knowledge beneficial for the carriers of that knowledge?

Two conditions have been mentioned: Acceptance of pluralism and symmetry in power. Knowledges and sciences are not universal; they are the result of social processes and these are pluralistic by definition. Symmetry in power will prevent a dominant system determining the rules of the game. Local knowledge should not be assessed by the criteria and methods used by global science, or the other way around.

But, in the current international scene, acceptance of pluralism and symmetry of power is far from reality. Acceptance of pluralism, of different ways of knowing goes against the claim of universality of (western) science. The west has a dominant position in the globe, economically, ideologically and scientifically, and this makes a symmetric relationship with non-western systems very difficult.

For an inter-scientific discussion, it is important to have a formulation of the characteristics of different ways of knowing. This characteristic can be made at three levels: in terms of the world-view (or ontology), in terms of sources of the knowledge and ways of learning (or gnoseology) and of the theoretical framework (epistemology).

This characterization can then lead to a self-assessment of the relative strengths and weaknesses of each knowledge and an assessment of the power relation between the systems involved. In the words of the Peruvian traditional scientist, Jose Illescas: intra-scientific dialogue and revitalization of indigenous knowledge is a precondition for inter-scientific dialogues.

Relations between different sciences and forms of knowledge

Interaction between different cultures may result from trade, migration, missionary activity, tourism, war or mass communication as well as from friendships and networks of solidarity and cooperation. The degree of reciprocal influence may vary greatly. In many cases, the more powerful culture dominates and, deliberately or by implication, has an influence on the less powerful culture. When analyzing the different ways in which sciences and forms of knowledges interrelate it would be impossible to discuss them all. There are many differences in the way different positions in power and differences in effectiveness of available technologies are being used and many differences in the way people react to domination.

Without claiming to be comprehensive, therefore, we have presented in the table below some of the possible relations between different forms of knowledge.

Table 1. Typology of relations between different forms of knowledge

Type	Characteristics	Examples
1. Clash or hostilities	Violent occupation, wars, resistance, fights between civilizations.	Fights between religions or on political lines; independence or resistance movements; terrorism and anti-terrorism.
2. Going underground	The suppressed knowledge continues to exist but not openly. In order to avoid repression, hostilities or rejection, local knowledge continues in a clandestine way.	There are many local knowledge systems: shamanism in Sri Lanka; spirit mediums in Africa; traditional leaders in the Andes.
3. Parallel knowledges	Different ways of knowing coexist openly without interaction: cultural or scientific apartheid.	Conventional medicine and Ayurvedic medicine coexisting in India; Islam, Christianity and other religions coexisting in Europe; conventional and biodynamic or organic farming; voluntary isolation from certain aspects of international exchange in a country like Bhutan.

Type	Characteristics	Examples
4. Utilitarianism and selective inclusion	Elements of local knowledge that can be scientifically understood or validated are accepted for enhancing the stock of scientific knowledge; may imply assessment of local knowledge by outside scientists and lead to *ex situ* conservation of local knowledge.	Aspirin is made, on the basis of a local practice already used by the Ancient Egyptians and Greeks, without their knowing its active ingredient. Local medicinal practices for malaria treatment; adoption of Arabic mathematics and Chinese gunpowder by western scientists
5. Substitution	The dominant system forces the introduction of exogenous concepts to substitute local traditions.	Missionary activities to substitute traditional religions; privatization of land; introduction of European languages as national language; exogenous rule of law to replace traditional juridical systems; republican and democratic systems of governance; hygiene measures as conditions for export.
6. Paternalism	Traditional knowledge is a starting point but must be "updated" by scientific contributions.	Transfer of technology in education, health and agricultural extension programmes.
7. Syncretism	The dominant and dominated systems merge and incorporate each others' rituals, beliefs and knowledge in such a way that *both* systems believe that their knowledge is the one that is dominant.	European knowledge with Cartesian knowledge and Catholicism merged with Andean or Maya beliefs, health practices and rituals.
8. Complementarity	Two different ways of knowing and using mechanisms of exchange and mutual learning aimed at complementing each other.	FRLHT† in India, with activities to exchange and compare different healthcare traditions.
9. Romanticism	Local knowledge is romanticized and considered basically "good" and should have the right to remain as it is.	"Going native", rejecting possible contributions of global science; enhancing capacity of resistance of local actors.

† FRLHT (Foundation for Revitalisation of Local Health Traditions)

Type	Characteristics	Examples
10. Coevolution	Different forms of knowledge evolve simultaneously, in the first place on the basis of their own dynamics (revitalization) and partly as a response to their interaction /dialogue with other forms of knowing.	Experiences of Compas partners in Europe (coexisting farming styles), Africa (Ghana and Zimbabwe), Latin America (Picads).
11. Trans-cultural and trans-disciplinary synergy	Sciences acknowledge that knowledge is always culturally embedded and forms a part of historic process. All can benefit from comprehensive interaction and possibly integrate in a way that goes beyond any particular culture or discipline.	Development of holistic medicine and health-care in industrialized and developing countries, or the clarification of interactions, which are not (yet) scientifically explainable. Work of Nicolescu, Sheldrake, Wilber and others.

Issues

The typology leads to six issues to consider when looking for an interrelation between different forms of knowledge:

- First, owing to global interdependence and communication, almost any type of knowledge available today is influenced in some way or another by the dominant way of knowing. This makes it difficult to distinguish "pure intra-cultural ways of knowing". Yet, the regional Compas regional workshops provide important insights into the way of knowing in the different cultures of the South, and their differences with and relation to the dominant world-views and values.
- Second, the relative strength and position of a specific science is the result of the use of power. This means that the degree to which a certain way of knowing is spread and accepted may depend more on its power base than on its intrinsic quality.
- Third, the global domination of the rationalist way of knowing and the emphasis on the use of knowledge for unlimited accumulation of material wealth and political creates important ecological, economic and social problems at global level.
- Fourth, a mutual learning process and dialogue between different types of knowledge involves the revision of power, values and world-views. This is the condition required to overcome the suppression and paternalism mentioned in the typology.
- Fifth, in the inter-scientific dialogue, emphasis needs to be placed on a reflection on what the specific starting position of each form of knowledge is: What are the world-views and sources of knowing (the role of rationality and intuition, the values involved and the way meaning is ascribed to things)? How does it relate to the natural, social and spiritual worlds? How is it placed in terms of power and

conflicts? On the basis of these, a process of intra-scientific dialogue can be designed that aims at the revitalization of the form of knowledge.

- Sixth, the idea of integration of (scientific and local) knowledge, by taking the best of both, is not realistic in all circumstances. Sometimes different knowledges have contradictory or mutually exclusive positions. For example, the hegemony between mind and matter may be seen differently; the notion of connectivity and unity may be different from the notion of separation and disciplinarity. Rather than having the idea that the end of inter-scientific dialogues would be one integrated scientific construction, we may have to accept or embrace the fact that a diversity of ways of knowing exists, each unravelling part of the complex reality.

The voices from the South feel the challenge to revitalize their own knowledge, to make the link with their own culture and to bring about a development path that is not just repeating the western model but that takes advantage of the strengths of their own values, world-views and expertise. They do not claim isolationism but expect benefits from South–South cooperation as well as from North–South exchange.

Coevolution of sciences

Compas wants to provide a platform for inter-scientific dialogue that can contribute to a co-evolution of sciences. In this process, each science involved is stimulated to evolve (to develop and improve its methods and theories) on the basis of its own dynamics as well as on interaction with other systems of knowing.

The *objectives* of the intra- and inter-scientific dialogues are

- To understand, describe and exchange the ontologies, gnoseologies and epistemologies of the sciences involved;
- To determine the strengths, weaknesses and comparative advantage of each science;
- To strengthen and revitalize marginalized sciences ;
- To look for synergy and opportunities for mutual learning as well as for contradictions and exclusions;
- To question, challenge and criticize oneself and each other in order to determine those aspects of the science and value systems that need modification and improvement;
- To balance the power and financial resource base of the different sciences.

The epistemological interpretation of the different Asian, African and Latin American and European knowledge systems, their ways of learning and experimenting and their mutual relationships need attention. Therefore, it is important to systematize and make more explicit the concepts and theories behind indigenous forms of knowledge in order to share them as part of a possible coevolution of the diversity of sciences.

The partners have agreed to work with rural people according to a code of conduct that respects the diversity of ways of knowing, accepts and supports the local ownership of local knowledge and local development processes, defines a complementary role outsiders may play and accepts the need to learn from and with local people. Publications are mainly aimed at strengthening local ways of knowing,

and are written as far as possible in local languages. Publications avoid mentioning technical details but focus on methods and strategic issues.

Towards a strategy

Actors involved

Given the wide range of options in belief systems, values, practices, knowledge concepts, and power positions, there are many modalities for intra- and inter-cultural relations. The present dominant position of materialist values and global technologies tends to marginalize minority cultures and diminish cultural and biological diversity. Therefore, to achieve a more egalitarian, just and sustainable relationship between different forms of knowledge, new paths have to be explored.

Building on the analyses and arguments discussed so far we suggest an intra- and inter-cultural social learning process carried out by multiple actors. The process will include at least the following actors: local people; their intellectual, political and spiritual leaders; local NGOs; government agencies for rural development; education and research; educational institutes and research centres. However, also national and international donors and development agencies can play their role.

Each actor can contribute to the social learning process in their own unique way. Local people can share their local knowledge. NGOs and governmental development agencies can support the process of revitalization and improvement of the local knowledge and way of knowing. Schools can include local forms of knowledge in their curriculum. Universities and research centres can do supportive research on the epistemologies and support the action research programmes. National governments can give policy priority to endogenous development and revise their current mechanisms for development in this light. International agencies for research and development and donor agencies can make available funds for these activities. International media of communication can be used to give credibility and prestige to this process and to support the mutual exchange process.

In fact, the choice for endogenous development and for coevolution of forms of knowing is a major paradigm shift that will not take place easily. The present systems for research and development have their own interest in the continuation of the status quo. Therefore, a careful strategy of activities at different levels will be important.

Possible activities

Below we present a number of activities that together could contribute to an approach for actors in the Compas programme, i.e., local communities, NGOs, universities and regional and international coordination units.

Rebuilding relationships

A prime condition for successful cooperation of these actors will be a relationship between actors that is horizontal as far as possible and is characterized by mutual interest and confidence. Hence, the first step to take is to critically analyze and reconstruct the different relationships as they currently exist. NGOs working with rural people have to make clear that their role is not that of an external agent who

comes with a certain message or technology to be transferred. Learning with and from local people and working on the basis of their cosmovision implies that the outsiders accept the rules of the game as expressed by the communities. The traditional codes for hospitality, confidence building, respect and communication have to be accepted and obeyed. This may mean procedures of selection and processes of initiation and participation in rituals that have a different cultural background and meaning for local people than for outsiders. Universities have to accept the fact that their conventional knowledge has its limitations, and also have to accept that their role in this process is predominantly one of learning. The funding agencies have to get used to a downward accountability. The international coordinators should learn from and with the regional coordinators and these with the local partners and these in turn with the local communities. The communication and interaction will not only be about conventional professional subjects but may also involve spiritual and cultural aspects, and a lot will depend on good social relations and skills. This means that the role of supporting people and organizations changes radically: Instead of teaching local people how to resolve their manifold problems, they concentrate on learning from local people as the basis for exploring possible synergies between different forms of knowledge. External actors become companions and animators of communications within and between different groups related to endogenous development. Instead of aiming directly at participatory development of technologies, they become agents for participatory skill and competence development involving local as well as external people, aiming at enhancing and broadening local control on development. This requires a process of personal preparation where the conventional professional standards, attitudes and skills are scrutinized and modified where necessary.

Intra-community dialogue and decisions about possible interactions with outsiders

An inter-cultural dialogue and a process of coevolution require that the different parties involved are prepared and interested in exchange. Yet, it is not evident that local communities, traditional experts and spiritual or political leaders are positive about it. Keeping local knowledge separate, or hidden from the eyes of outsiders, can be used as a defence mechanism, as a way to protect the traditions and to be free from external influence. Also, within a community there may be different positions: not everybody will have the same interest and position. Differences in gender, age, social position, class, caste, professional background, can lead to a different knowledge, value and position towards exchange with others. Therefore, before we can assume that an inter-cultural dialogue is desirable and possible, we need to have a view of the community as it is differentiated in social class, gender, age groups. How do they see their situation: the potentials and risks of exchange, possible synergies, power relationships, conflicts? What would be the strategies for negotiation and joint learning?

Which internal and external factors do local actors consider to be responsible for strengthening or debilitating endogenous development and the cultures in which they are rooted? Which points are considered important for the traditional culture to be maintained, and what points from the dominant or formal system can to a certain extent be included into the traditional system and who decides on this? This then

leads to a vision on the desired closeness or distance of collaboration: on the desirability of the ways, contents and partners of a coevolution.

Learning about cosmovision, sources and forms of knowledge within the cultures

This activity consists of trying to understand the way of knowing within the cultures involved in this process. The cosmovision, values, the way people learn, teach and experiment and their logic and knowledge concepts and theories must be made clear and understood in order to be able to have internal reflection on the strong and weak points of their own knowledge. We could try to understand the cosmovisions, how the different sources of knowledge, like rationality, intuition, inspiration etc. are being used and combined and how they lead to the understanding by the holders of local knowledge. Sharing these aspects could then lead to a joint reflection. Specific needs can be identified for strengthening, revitalizing or enhancing the way of knowing. On the basis of these, possible changes required in relation to traditional education, training, research or macro conditions and policy environment can be identified.

Learning from the community experience of coping with the dominant system

It is important to find out to what extent the local communities are already dealing with the dominant system. Is it possible to describe the relationship of the local culture and the way of knowing with the formal/dominant system in the area? Can the typology presented in this paper be used to make such a description? Can we learn from the community how they have managed to survive/change and coevolve with the dominant/formal system? How do they do it and how shall we as NGOs, universities or other supporting organizations relate to that, and how do we deal with this when certain value differences between them and us become clear? What are the possibilities and limitations for inter-cultural dialogue?

Dealing with strong and weak points of the local forms of knowledge

On the basis of a self-assessment of the sources (e.g. rationality and intuition), proposals can be formulated to revitalize local knowledge. Suggestions can include transformation of existing mechanisms of learning and teaching, recovery of lost knowledge, mobilization of people or resources to come to grips with local knowledge, or healing of practices that are considered ineffective or detrimental. For each of these possible options, appropriate approaches can be chosen. These approaches could initially be chosen from the available scale of indigenous options. This may be an important focus of the action–research activities for endogenous development of the partners involved.

Dealing with strong and weak points of the dominant forms of knowledge

The basic hypothesis of this paper is that western knowledge is one of the possible forms of knowledge. It is not universally applicable. It has its own strengths and weaknesses. An inter-cultural dialogue based on mutual confidence and horizontal relationships can only take place if all partners involved are prepared to have a self-

critical attitude. There are considerable theories and reflections on the character of western science. In the battlefield of knowledge, debates are held on issues such as objectivity versus subjectivity; universalism versus relativism; specialization and disciplinarity versus holism and trans-disciplinarity; quantitative method and qualitative methods; neopositivism and actor perspectives. Hence, it is clear that also within the dominant scientific tower, there are different perspectives and positions. Western knowledge applied to agriculture or health practices has a great impact on the globe. It has led to impressive results, but it has not been able to solve all problems related to food security, health, poverty, environmental sustainability and peace. Therefore, there is a perspective for inter-cultural and inter-scientific dialogue, on the condition that western science also accepts its limitations and is interested in finding ways to deal with them. The balance between the sources of knowing, rationality, quantification and the material world, on the one hand and empathy, intuition, sense and meaning on the other need to be explored and, where necessary, corrected. Non-western scientific traditions can offer a lot to western science.

Exchange of experiences and coevolution

An important step would be to look for opportunities for mutual learning and exchange and for coevolution. It could be understood as a dialogue between partners allowing themselves to maintain a certain degree of divergence between the different forms of knowledge involved. Respectful dialogue implies the willingness to listen, openness to learning, responsiveness to information, questions and suggestions as well as the courage to criticize when necessary. It needs to avoid the pitfalls of rejecting positive elements of deficient forms of knowledge, as well as avoiding the risk of romanticizing or idealizing any of the forms of knowledge involved. The question whether it is feasible to achieve inter-epistemological cooperation in the sense that it leads towards trans-cultural synergy has not yet been answered. Possibly this can only be done in a satisfactory way, once the local systems as well as global systems have gone through their own processes of transformation, recovery, mobilization and healing.

For the past 10 years, Compas has been learning about world-views and the ways of learning in different cultures. It was found that knowledge in the different cultures is not just a random compilation of subjective facts and culturally bound skills and practices: They form a more or less coherent set of views, perceptions and concepts and, in that sense, can be considered as sciences. For some cultures, these views, perceptions and concepts have been documented and been subject to modifications by research, testing, publication and dialogues through transparent processes of a multitude of actors. Scientists, spiritual leaders, policy-makers and general public as carriers and users of the knowledge all play their role in an interactive process of learning, testing and dialoguing. In other cultures, the dynamics of the views, perceptions and concepts has been less transparent, less open or less interactive. Not all cultures have a written tradition; some knowledge is kept secret and many cultures have been overpowered by others by which their own views, perceptions and concepts have been marginalized and or substituted.

Compas partners concluded that traditional world-views and practices are weakening under the influences of other cultures. They observed that this creates serious problems for sustainable development and cultural diversity. They experience

the economic and cultural influences from the west as being particularly threatening. For Compas, this raised the need to further analyze the relations between moving world-views, different sciences and sustainable development.

In the course of 2005 and 2006, the regional units of Compas in Latin America, Africa, Asia and Europe have made a systematic effort to assess the world-views and ways of knowing in each of the continents. The core question in each continent was to what extent can we present a picture of the (diversity of) world-views that coexist in the continent; to what extent can we understand the way people learn and can we consider the ways of knowing as a coherent set of notions?

In other words: What is the status of the world-views and sciences in Latin America, Africa, Asia and Europe?

So far, three regional conferences have been held: In August 2005, Compas Latin America organized the conference: Intra- and inter-science dialogues for strengthening the sciences of the indigenous peoples in America. In October, Compas Africa held the conference: African sciences, and in November, Compas Europe held the conference: Moving world-views; reshaping sciences, policies and practices for sustainable endogenous development. In July 2006, the regional conference for India and Sri Lanka was held.

In October 2006, an international conference will be held where the conclusions of the four regional conferences will be brought together and where an inter-cultural and inter-scientific dialogue will take place.

American sciences

The Latin American conference was held in September 2005. It had the title *"**Inter-cultural and inter-scientific dialogue of the original peoples of the Americas**"*. Participants were indigenous leaders, university professors, students, school teachers and NGO staff; in total about 80 participants from different Latin American countries.

Native societies are based on intense relationships between the spiritual, social and natural domains of life. They do not see the world as separate entities or as a duality. Their science is not a combination of individual disciplines but is an integration of the natural, the social and the spiritual aspects in one inseparable whole.

The traditional economy is based on reciprocity between man, nature and divine beings. Redistribution of wealth generally takes place through a variety of mechanisms. These notions may provide an alternative to the capitalist economy that is based on individualism, exploitation and accumulation of wealth or power. Native societies are aiming at intra-cultural dialogues and dialogues within their own communities, in order to revitalize their own cultures and knowledge. It is clear that education is playing a very fundamental role in this.

These societies are eager to learn from and with other cultures. The west can support them to increase their productivity and reduce poverty. But economic development should respect the ecological balances, social harmony and reciprocity.

Discussions in this conference were focused on how to reform the public universities within Bolivia and other South American countries.

The rector of the University of Cochabamba in Bolivia stated that it was necessary to change the content of higher education with respect to intra- and inter-

cultural dialogue. This means that new research approaches are needed and that participation of other social actors within the university has to increase. The reform should be a social learning process leading to a transformation of the conventional university into an inter-cultural university where a diversity of western and American notions are being offered in education and research. Unless a strengthening and revitalization of the native cultures is also taking place, and unless the native languages and traditional notions of sacred nature, social cohesion and spirituality are taught at schools, no inter-culturality can take place. The dominant position of the western knowledge, the wide use of the Spanish language and the aggressive commercial corporations would lead to the further marginalization of local culture.

African sciences

The International Conference on African Sciences had participants from all parts of Africa south of the Sahara. There were traditional leaders and people from universities, NGOs and GOs.

The conference made an effort to construct the African way of knowing, by revisiting traditional knowledge and learning systems. Within the different regions in Africa people commonly have a relationship with their ancestors. In Africa, the spiritual, human and natural worlds are all interlinked. The basic understanding is that there is a link between the living, the dead, the ancestors and the yet to be born. The cycle of life and death involves the spiritual beings, the unborn beings, the living, the dead, the ancestors and the beings to be reborn. The transitions from one ontological stage to the other coincide with a number of practices and rituals and for each of them traditional specialists have to perform certain functions. For this they have to be trained and initiated. The processes involve knowledge and skills that are handed down through oral (non-written) methods. The knowledge involved make up an important part of African sciences.

An African concept of "maternal force" gives an expression of gender. An inventory of technologies that have evolved from African culture include subjects like agriculture, health, mathematics, metallurgy and construction.

Each African has a totemic relationship with an animal or plant. He or she has the obligation to protect that animal or plant, and persons belonging to the same totem have a special relationship with each other, crosscutting possible ethnic, social or professional boundaries.

African cultures also realized the need to strengthen intra-cultural dialogues. African culture(s) have to a large extent lost the tradition of self-reflection and internal discussion on their identities, knowledge, systems of governance, justice and the accountability of traditional leaders. Identifying the strong and weak points of their own culture and traditional knowledge and identifying ways to improve them is a necessary step for endogenous development.

The conference participants expressed themselves in favour of strengthening South–South relationships while at the same time, maintaining a relationship with the North. The conference ended up with a Policy Report that took the position that in Africa at the material level, poverty is widespread. Yet at the social and spiritual levels, Africa is strong and has something to offer to the other Southern regions and the North. The conference had recommendations for the participating universities to help

strengthen their own curricula with a focus on African sciences and for collaboration with traditional scientists in university programmes.

Moving world-views and sciences in Europe

The participants of the European conference agreed that the western world-view is dominated by dualistic and materialistic notions. It separates mind and matter, man and nature, the creator and the created, object and subject. This dominant western world-view is at least partly responsible for the polycrisis in the world: The ecological crises, persisting poverty, social tensions and insecurity and proliferation of weapons of mass destruction.

This world-view is being challenged from several angles. More and more the conventional, materialistic and science-based approaches to development are being questioned, and innovative individuals, citizen groups, scientists and policy-makers are increasingly presenting new ideas on how things can be done. Participants recommend that the west:

1. Look at its history and reconnect with its historic identity: The era prior to the introduction of duality should be studied. Germanic and Celtic roots of Europe can be a source of insights about the roots of western culture and ontology.
2. Go beyond the reductionist views of disciplinary science and include insights from quantum physics, uncertainty and chaos theories and trans-disciplinarity. Insights from complementary sciences in health, agriculture, education and other fields should be included.
3. Build on the wisdom of different social actors: NGOs, social movements, scientists, religious and spiritual leaders. The possible differences and complementarities of gender perspectives should be respected. The complementarity between science, morality and religions should be explored. The links with artists, visual artists, painters, poets and musicians should be strengthened.
4. Learn from non-western cultures their a-dualistic world-views, gnoseologies and epistemologies.

Each domain requires different methodological tools. In order to ensure that deeper levels of knowing are included in scientific building, it is suggested that the west move towards a new western gnoseology (i.e. a system of deeper knowing) based on a combination of rationality, intuition, imagination and sensibility. Such an approach attaches value to dialogues across ideologies, sciences, religions, economies and policies. It has respect for otherness and diversity, uses rigorous arguments, taking into account all existing information. It suggests openness to accept the unknown, the unexpected and the unforeseeable and tolerance to accept opposite views.

The increasing awareness of the importance of culture and cultural diversity is leading to an increase in intra- and inter-cultural education. The educational systems, systems of governance and management of the local resources increasingly get attention. In these domains, important innovative initiatives are being undertaken in the South.

Dilemmas and challenges

The issue of inter-science dialogue poses interesting dilemmas and important challenges. They have to do with the intra-cultural processes, with the relations between different ways of knowing, with the vision on the end product and process of dialogues and with professional and personal choices.

The first cluster of dilemmas are related to the **intra-cultural process**: In my observation, this is one of the biggest challenges of Vedic, Buddhist and other ethno or cultural sciences. This intra-cultural dialogue could address questions such as

- How can we understand and formulate our own ontology, gnoseology and epistemology?
- How can we take our own culture and science serious and avoid the pitfalls of unjustified skepsis and that of romanticization?
- How to make a valuable assessment of the strong and the weak points of one's own knowledge system?
- How to address the weak and retrogressive points and how to build on the strong ones?
- How to deal with internal differences and visions between Vedic, Buddhist and tribal knowledge and between different schools or lineages in each of these ways of knowing?
- How to revise and improve one's own cosmovisions and metaphysics in the light of the further understanding of nature?
- How to deal with the difference between beliefs, religions and factual knowing based on sensory experiences?
- How to test and improve the technologies in different fields of specialization on the basis of well chosen parameters and research methods that are in line with one's own theories?
- To what extent and under what conditions are we interested in having dialogues with the dominant way of knowing and with other ways of knowing?
- How to deal with issues such as power, politics and poverty?

There are no easy answers to these questions. Where **beliefs and sciences** come close together, critical self-reflection may be difficult and testing and experimenting may become problematic. On the one hand it is sometimes claimed that certain methods are only effective if one believes in them. Medical treatments with rituals, prayers or use of supernatural powers do require an emotional and/or spiritual surrender. This makes testing in the Cartesian way very difficult if not contradictory to the core notion of that particular belief/practice/knowledge. On the other hand, if one's own positions are not allowed to be examined and questioned, the risk of fundamentalism and lack of dynamics is there. In each situation, therefore, the rules of the game of the intra-cultural dialogue have to be agreed upon.

Sometimes, it is suggested that non-western sciences show similarities and convergences with western sciences or that their relevance can be shown by using western scientific parameters. Ayurvedic medicine is effective, and this can be shown by double blind tests of the herbal drugs. As such, there is nothing wrong with this type of research, but treating non-western sciences and technologies merely as artefacts that need to be tested with western parameters does injustice to the intrinsic

value and otherness of these ways of knowing and may focus the attention on the materialist aspects. Ayurvedic medicine may very well benefit from testing and experimenting, but the challenge is to use the parameters of Vedic science. Equally challenging is the research on the use of mantras by making use of the parameters of Buddhist and tribal knowledge.

At the same time, the design of **research methods** based on one's own parameters and criteria is not easy. And conventional research agencies and traditional centres of knowing often do not have expertise in this field. Therefore, new partnerships between traditional experts and conventional researchers may have to be set up.

In India and Sri Lanka, this process has not been without difficulties. I have noted that the terms "spirituality" and "spiritualism" are sometimes confused. Reluctance has been observed in the initiatives to carry out testing on practices such as the use of kems and mantras in agriculture and health. Understandably, a resistance has been shown to testing such practices the Cartesian way and in quantifying the process and the effects.

A part of this dilemma is the way the **political sensitivity** on traditional knowledge is being dealt with. In Sri Lanka, the Buddhist, the shamanistic and the Vedic knowledges and cultures sometimes syncretize, sometimes are in opposition to each other, and they all have a way of dealing with western sciences and ways of thinking. In India, the Hindutva movement is taking a certain stand on Vedic science and religion and is subject to strong political debates. In China, the traditional system Falang Gung has been declared illegal. Islamic perspectives and cosmovisions may clash with Christian and/or Hindu perspectives. Capitalism, globalization and neocolonial dominance is often associated with Christianity, with social Darwinism and/or with materialistic atheism.

Neglecting these social and political tensions would do injustice to the complex reality, but addressing it is not an easy thing to do.

The second cluster of challenges exists in taking **a position on other ways of knowing**. This includes taking a position on the dominant or conventional science as well as on other ethno-sciences. The local knowledges need to define their position with respect to the various possible relationships mentioned between knowledge systems. They need to reflect on how they can turn domination and marginalization into symmetry and possible synergy.

It is possible to reject **conventional science** as an exponent of dominant western powers. Personally, I feel this would be a rather problematic position. Much as it is true that western organizations and nations have used conventional science to develop technologies for weapons, for exploitation of natural resources and for developing systems of social control and coercive management, this does not make all the science developed in the west dangerous or an instrument of aggression or destruction. Western society is not a monolith of power usurpers and repressors. Also, in the west, there has been and still is an internal struggle between the powerful and the less powerful, the rich and the poor, men and women. And science and technology has been developed in this polarity. Conventional science is no monolith either. Quantum physics, computer technology, social learning and trans-disciplinarity, Marxism and human rights are as much a result of conventional science and western philosophy as atomic weapons, capitalism and social Darwinism. There is much to be

done to improve conventional science and to develop constructive technologies, but to reject conventional science in its entirety would be throwing out the baby with the bathwater. How to reconcile the dualistic notion with a-duality is a point that needs further reflection.

The position towards other **non-western sciences** is another delicate point and leads to questions:

- Are all local sciences equally scientific by the standards of ones own science, by the standards of their own and by the standards of the dominant science?
- Are written cultures superior to oral cultures?
- Is it possible to appreciate and understand spiritual traditions from other origins?

I remember a meeting in Chennai where a spiritual leader of the Mayas held a ritual according to their own methods. At the end, some participants from Asia were shocked because during an act of purification the leader used water, took it in his mouth and blew it over the participants. In the Asian context, spitting saliva is considered an insult. Equally problematic may be the differences in the use of food items, alcohol and drugs.

Another dilemma is the question of the **expected outcome and rules of the game for the inter-scientific dialogue**:

- Can we be comfortable with the idea that sciences can be different and yet benefit from exchange? How can we deal with the idea of pluriformity and symmetry?
- Is it our expectation that in the end all sciences will flow into one main stream, or do we expect and appreciate different flows to coexist?
- Is it possible to mix and match techniques from different scientific origins by taking the "best of both" (hybridization)?
- To what extent and under what conditions is this hybridization possible and where will it become detrimental to either or both of the sciences?
- Is the use of hygiene, disinfectants, X-rays or antibiotics in combination with traditional or classical medicine an advantage or a problem? And what about the use of pesticides, machines and genetically modified plants in traditional agriculture?
- How can we combine concepts and techniques from different sciences from the South?
- Is the combination of duality and a-duality a realistic option, or is it intrinsically inconsistent and heading to an eventual domination of one of the two?
- Do we have to choose one of the two options or could we accept the idea that both duality and a-duality may be possible, and could both possibly benefit from intra-cultural dialogues and possibly also from an inter-cultural exchange?

The ultimate dilemma is the **professional choice**: Opting for one or other position outside the mainstream requires a personal conviction as well as courage to follow the ideas and bring them into the professional domain. It may be followed by scepticism, ridicule; it may lead to less chances in ones career, difficulties in finding funding etc. It requires courage and ingenuity.

Utilizing Traditional Knowledge in Agriculture

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Abstract

Indian agriculture is at least 10,000 years old. Over millennia, farmers and sages developed innumerable practices to successfully grow crops and raise animals in the highly diversified agro-ecological regions of the Indian subcontinent. Basic principles to grow crops and manage animals were worked out through experience and experimental research. The last 170 years have brought in new techniques, some useful and some harmful.

After the "Green Revolution", it was realized that high-input agriculture could only benefit about 30% resource-rich farmers, leaving out the remaining 70% resource-poor farmers. If these poor farmers are to raise their living standards, they will need more efficient techniques that will only require locally available, low-cost inputs. I believe our ancient knowledge can help these poor farmers, especially those who depend on rainfall alone.

Over the last 10 years, it has been possible to document traditional practices and to discover "lost" texts on agriculture. We know of many techniques that were used in the past but have been forgotten. There is a great need to validate many of these potentially useful techniques through research.

The paper includes examples of techniques that need to be validated and discusses ways of carrying out the validation.

Indian agriculture is at least 10,000 years old. We know this because by the time the *Rigveda* (c. 8000 BC) was compiled, basic farm operations, as practiced today, had been worked out. Animals were domesticated and utilized for various purposes. New crops and the agronomic knowledge associated with them were being added to farming over the millennia. Today, India grows a very large number of crops because of the availability of diverse agro-ecological conditions. All through this period, until the advent of "modern" agriculture in the last two centuries, farmers themselves, with advice from sages, developed and fine-tuned crop production technologies. Almost all farm activities were based on the local availability of material and human resources. In other words, there was hardly any need to "purchase" external inputs.

During British rule, India's agriculture suffered a lot because of insecurity, interference with land ownership systems and emphasis on Europeanizing Indian agriculture. Farmers carried on their own traditional agriculture only halfheartedly. When India became independent, its food security was minimal. This led to regular annual import of food.

Though the Green Revolution is criticized today by many people, I must state that it was absolutely necessary to increase agricultural production. Food security is a basic prerequisite for the self-respect of any country. Since the Green Revolution was based on high-input, intensive agriculture, we ran into problems such as the erosion of resources and also the neglect of resource-poor farmers. If the resource-poor farmers are to raise their living standards, they will need to learn highly efficient techniques that depend on locally available, low-cost inputs. I believe the knowledge that we

gained in ancient and medieval periods can help resource-poor farmers today, especially those who depend on rainfall alone as source of water.

We must give credit to George Watt, a British botanist, who included a compilation of traditional agricultural techniques in his multi-volume Economic Products of India, published between 1889 and 1893. From his books, we can get a glimpse of the practices followed by farmers of the Indian subcontinent in the 19th century.

After a long gap, interest in documenting traditional agricultural practices rose as the ill effects of the Green Revolution became evident. The Indian Council of Agriculture recently documented currently used traditional practices.

Over the last 10 years, the Asian Agri-History Foundation, Secunderabad has published English translations of one Kannada (*Lokopakara*, 1025 AD), one Persian (*Nuskha Dar Fanni-Falahat,* c. 1650) and four Sanskrit (Surapala's V*rkshayurveda*, c.1000 AD; *Krishi-Parashara,* c. 400 BC; *Kashyapiyakrishisukti*, c. 800 AD and *Vishvavallabha*, 1577 AD) texts. We now know many ancient and medieval techniques that had been forgotten.

While we have a good knowledge of the traditional agricultural practices followed by resource-poor farmers, we have very few research institutions willing to carry out validation research involving traditional techniques. The national agricultural research system (the Indian Council of Agricultural Research, agricultural universities and others) by and large has focused its attention on agri-business, i.e., on resource-rich farmers. This is very unfortunate!

There are many techniques of traditional agriculture that require validation. Some of these materials and practices need early attention, such as those shown in the table 1 and discussed below.

Table 1. Materials recommended by Surapala to control tree disorders, and their currently known properties

Materials	Properties
Plant species	
Acorus calamus L.	Antibacterial
Aegle marmelos (L.) Corr. *(panchamula)* †	Antifungal; antibacterial; nematicidal; anthelmintic
Brassica alba (L.) Rabenh./ *Sinapis alba* L. (white mustard)	Insect antixenosis; antifungal; acaricidal; nematicidal; glucosinolate sinalbin "anti-insect" and "anti-nematode"; allyl isothiosinate antifungal
Clerodendrum phlomidis L. f. *(panchmula)*	Molluscicidal; antifungal; antiviral; antifeedant; leaf (neoclerodane diterpenes) antibacterial, antifungal and molluscicidal. Induces systemically acquired resistance (SAR) against viral diseases acquired resistance (SAR) against viral diseases

† *Panchamula* - roots of five plants; the species are indicated

Materials	Properties
Plant species	
Curcuma longa Koenig non L./ *C. domestica* Val. (turmeric)	Antioxidative curcuminoids; antimicrobial
Embelia ribes Burm. F.	Anthelmintic; antibacterial; insecticidal (embelinbenzoquinone)
Emblica officinalis Gaertn. *(triphala)* ‡	Anthelmintic with other two species of *triphala*
Ferula asafoetida L.	Antimicrobial (contains resin 40–60%; volatile oil – 10–17%)
Ficus benghalensis L. (banyan)	Latex with good sealing properties; tannin
Ficus glomerata Roxb.	Latex; bark 14% tannin; some *Ficus sp*. are antibacterial
Glycyrrhiza glabra L. (liquorice)	Antimicrobial saponins; glycyrrhizin in underground parts
Gmelina arborea L. *(panchamula)*	Bark and roots contain alkaloids; resinous substances present
Madhuca indica J.F. Gmel. (*madhuka*)	Oil cake insecticidal and piscicidal; contains saponin (mowrin); flowers antibacterial
Oroxylum indicum (L.) Vent. *(panchamula)*	Antiseptic; bark contains alkaloids, tannins and glucoside tetuine
Piper nigrum L. (black pepper)	Oleoresin antibacterial/antifungal; alkaloid piperin is insecticidal
Semecarpus anacardium L.f. (*bhallataka*; marking nut)	Antiseptic; insecticidal; termite repellent; antifungal; antibacterial; fruits anthelmintic
Sesamum indicum L. (sesame)	Insecticidal and repellent; oil synergistic to pyrethrums; antioxidative lignins in seed; 17% protein; 800 mg per 100 g calcium, phosphorus, and potassium; 14% iron (ash) – highest
S*olanum indicum* L.	Fruits/leaves antifungal/antibacterial; glyco-alkaloid solasonine present
Stereospermum suaveolens DC. (*panchamula*)	Antifungal; antibacterial; bark also has same properties
Terminalia bellirica (Gaertn.) Roxb. *(*triphala*)*	Antimicrobial properties
T. chebula Retz. *(*triphala*)*	Anthelmintic properties

‡ *Triphala* - three fruits; dried powder is used in mixture; the species are indicated

Animal products and other materials	
Materials	**Properties**
Animal fat	Saponification after release of fatty acids; anti-microbial antimicrobial
Ash	Particles hygroscopic; absorb moisture from insect eggs and spores; interfere with insect feeding; ash potassium interacts with surface fats potassium interacts with surface fats
Brick powder	Action similar to that of ash particles except that these particles are inert
Buffalo horn	Contains keratin, a protein that contains 24% cystine, a sulphur-containing amino acid; used for smoking (fumigation) trees
Cow dung	With urine it is antiseptic; rich in bacteria that compete with pathogens; good medium for biocontrol agents; beneficial to *Rhizobium* and *Azobacter*
Cow horn	Same as buffalo horn
Crab shells	Rich source of chitin from which chitosan, a polymer, is made; induces systemic resistance in plants; used in smoking tree wounds
Fish meal	Rich in protein; releases amino acids including praline
Flesh	Same as fish meal; serves as an excellent medium for bacteria that may antagonize plant pathogens; attached connective tissue rich in proline
Ghee	Same as animal fat
Hemp fibre	Used for making smoke
Hog fat	Same as animal fat
Honey	Antimicrobial; protects wounds in plants/animals; proline present; honey-bee peptide apidaecin is antibacterial
Horse hair	High amounts of keratin; used in fumigation
Liquid manure (kunapa)	Effects would include: healthy crop/tree; crop tolerance to abiotic stresses such as frost, heat etc. as well as to insect pests and diseases; high yields; high quality produce
Lotus mud	Stickiness due to a high viscosity exo-polysaccharide, comparable to xanthan, produced by *Azobacter vinelandii* present in rhizosphere of rhizomes
Marrow	Fats and blood; rich in phosphorus
Milk	Glutamate, leucine and proline make up 40% of the total amino acids in the milk of all animals; mass rearing of *Trichogramma*; sticker-spreader; induces systemic resistance in chilli against leaf-curl
Proline (present in some of the above materials)	Induces systemic resistance in plants; stimulates production of antimicro-bial phenolics; high endogenous proline increases contents of cytokins and axons; protects against stresses – salts, drought etc.; proline-rich peptides antimicrobial; an important ingredient of parasitic diets; provides power for insect flight metabolites

Milk and milk products

Milk and ghee have been used for centuries. Even buttermilk was found useful. Glutamate, leucine and proline make up about 40% of the total amino acids in milk. Milk is reported to contain plant growth promoters. A recent report (Arun Kumar *et al.*, 2002) claimed that spraying with milk induced systemically acquired resistance (SAR) in chilli against leaf-curl, a viral disease. Milk (10% aqueous suspension) has also been used effectively for controlling powdery mildews. Besides, milk has excellent sticker-spreader properties.

The amino acid proline has been found to systemically induce resistance in plants. It stimulates production of antimicrobial phenolics. High amounts of endogenous proline increase contents of cytokinins and auxins. Apart from milk, proline is present in the connective tissues of animals including fish. Here is an excellent opportunity for us to rediscover the beneficial effects of milk.

Application of cow dung

Use of cow dung for dressing seeds, plastering cut ends of vegetative propagating units such as sugarcane setts, dressing wounds, sprinkling as a diluted suspension on plants and applying to soil has been indicated since the time of Kautilya (c. 300 BC). Indian farmers continue to use cow dung in various ways, but agricultural scientists have ignored its use except as manure (Nene, 1999).

Briefly speaking, cow dung from the cattle shed is a mixture of dung and urine, generally in a ratio of 3:1. Cow dung consists of crude fibre, crude protein and materials that can be obtained in nitrogen-free extracts and ether extracts. Cellulose along with lignin makes up most of the crude fibre; hemicelluloses and pentosans (polysaccharides based on pentose sugars) are also present. Micronutrients too are present in cow dung. The urine portion of cow dung contains nitrogen, potash and sulphur and traces of phosphorus. The nitrogenous compounds excreted in faecal matter consist in part of undigested or unabsorbed food nitrogen and in part of another fraction called metabolic nitrogen. The metabolic fraction comprises substances originating in the body such as residues of bile and other digestive juices, epithelial cells from the alimentary tract and bacterial residues. In short, faecal residues comprise undigested fibre, debris from sloughed-off intestinal epithelium, some excreted products derived from bile (e.g. pigments), intestinal bacteria and mucus. There are more than 60 species of bacteria and over 100 species of protozoa encountered in the rumen of a cow. A majority of the bacteria are cellulose, hemicellulose and pectin fermenters. The bile constituents are bile salts, acids and pigments. Bile salts confer a hydrophilic coat to otherwise hydrophobic droplets, thus acting as emulsifying agents. No bile salt is supposed to be present in dung because these are reabsorbed through the intestine and are returned to the bile. However, in each such cycle (enterhepatic circulation) involving bile salts, a small part is lost through bacterial degradation in the faeces as dyslysin, which is the slimy material. Bile salts have antiseptic properties. The two chief bile pigments are bilirubin (reddish/golden yellow) and biliverdin (green). It is biliverdin that is chiefly present in herbivorous animals and that gives dung its greenish colour (Nene, 1999).

Thus, when seeds are treated in various ways with cow dung, they get coated (pelleted) with cow dung residue. This residue contains cellulose, hemicelluloses, micronutrients, metabolic nitrogen, epithelial cells from the animal, bile salts and pigments, potash, sulphur, traces of phosphorus and a large number of bacteria, the majority of which are cellulose, hemicellulose and pectin fermenters. The cow dung residue has emulsifying properties. A thin dry layer of cow dung on a seed acts like blotting paper and readily absorbs moisture from the surrounding soil, which is to the advantage of the seed. The presence of bacteria in the residue may antagonize potential pathogens ready to attack the seed. According to Foster *et al.* (1983), since root tip mucilage consists, in part, of complex carbohydrates such as cellulose, hemicelluloses and pectin, bacteria that have the ability to use these carbohydrates might get a competitive advantage. In this context, the bacteria found in cow dung would be most suitable as they have the capacity to utilize cellulose, hemicelluloses and pectin. In other words, these cow dung bacteria can quickly colonize the area around sown seeds and thus compete with potentially pathogenic fungi and bacteria and prevent them from attacking the seeds. It is pertinent to note here that one of the fungi commonly used for biocontrol (*Trichoderma hamatum* (Bonord.) Bain) produces the enzyme cellulase and therefore has good competitive saprophytic abilities. If cow dung bacteria possess the ability to produce siderophores (low molecular weight, high affinity iron (III) chelators) and/or the ability to induce systemic disease resistance (van Loon *et al.*, 1998), they could very effectively protect seeds from pathogens. As the use of cow dung for treating seeds has continued for millennia, it is obvious that Indian farmers are convinced of its utility. Many present-day agricultural scientists, who have no experience of living in rural areas, may be “averse” to the idea of doing research on cow dung. However, true, dedicated scientists will not hesitate to take up the work, as there is a lot to learn about the role of cow dung in maintaining seed health. Cow dung on seeds must play a role in the biocontrol of potential pathogens; we just need to scientifically investigate it. This should attract the attention of scientists interested in biological control. If dressing seeds with cow dung is found to be effective in ensuring good germination and emergence in field conditions, existing seed processing plants could use a cow dung slurry or dried cow dung dust to treat seeds on a large scale. Dried cow dung powder could be applied to soil to promote biocontrol. It is gratifying to note that Khanuja *et al.* (2003) have identified a crystalline “cow urine distillate fraction” that enhances the activity of antimicrobial agents (US patent no. 6,410,059). Chakrapani Mishra (Sadhale, 2004) in *Vishvavallabha* (1577 AD) recommends using extracts of cow urine in herbal insecticides, which makes sense in the light of the findings of Khanuja *et al.* Also, farmyard manure has recently been used for mass multiplication of *Trichoderma harzanianum* and *Pseudomonas fluorescens* (personal communication – N.W. Zaidi and U.S. Singh).

Liquid manure (*kunapajala*)

Preparation of *kunapajala*, or liquid manure, involves boiling the flesh, fat and marrow of animals such as deer, pigs, fish, sheep or goats in water, placing the boiled matter in an earthen pot and adding milk; the powders of sesame oil cake; black gram boiled in honey; a decoction of pulses; ghee and hot water. There is no fixed proportion for the ingredients. The pot should be put in a warm place for two weeks. The resultant

fermented liquid is a manure called *kunapajala*. Research is needed to standardize and test this manure in orchards.

All the materials need detailed research so that we can provide acceptable scientific evidence to support the recommendations made by Surapala. In fact, we might find opportunities to simplify the procedures. We might also have opportunities to patent the use of some of the materials and procedures.

It is well known that manure from animal wastes is better for plants than the composts made from plant residues. With plant-based composts, there is always a danger of passing on dormant pathogens to fields. There should be no such danger with the application of *kunapajala*. Also, animal wastes are likely to have microflora that might provide better biocontrol of plant pathogens and diseases than plant-based composts.

It is worth pointing that Firminger (1864) who was a "Chaplain of the Bengal Establishment" mentions in his manual of gardening the beneficial use of a "liquid manure", prepared the way *kunapajala* was prepared, for vegetable cultivation. He has, however, given no information about who first thought of "liquid manure".

There are many other areas of possible research. Opportunities are waiting for young researchers.

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Nawakekulam - A Traditional Agricultural Practice of Sri Lanka[Ψ]

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Abstract

The current emphasis of international rice research is on direct seeding and minimizing water usage. If this were told to an elderly rice farmer in Sri Lanka, he would immediately say that that is "kekulama". Research conducted by the Ecological Conservation Organization (ECO) with the help of Ruhuna and Peradeniya Universities clearly indicates that the "kekulama" method of cultivation conserves more water compared with the conventional method of rice cultivation. Exposure of the findings of the research to organizations such as the Mahaweli Authority and NGOs concerned with rice cultivation and organic farming has led to the popularization of one of the most important features of "kekulama", that is, timely cultivation. Elderly farmers in dry zones stress that if timely cultivation is carried out yields are high and pest and disease incidence is low. But the responsible authorities took no initiative to implement timely cultivation. But faced with the evidence of the research findings, many organizations including the Mahaweli Authority commenced the introduction of timely cultivation. A survey done in Huruluwewa and Eppawala conclusively showed the truth of the old sayings. The yield increases are due to

a) Cold nights during then north-east monsoon season at a critical stage of the rice plant and long days during the south-west monsoon.
b) Build up of natural fertility at the end of each monsoon.
c) Poor insect build up at the beginning of the season.

Saving water by the "kekulama" method of cultivation can increase national rice production by over 70% by increasing the yield per acre and the cultivation index and by minimizing the time between the sown and harvested periods and by minimizing pest and disease incidences. This is an excellent example of endogenous development.

[Ψ] The full text of these papers are currently not available and hence the abstract alone has been presented here.

Documentation and Validation of Traditional Agricultural Practices

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Abstract

Two success stories on scouting for and documentation and validation of indigenous knowledge (IK) are presented here. The Gandhigram Rural Institute (GRI) executed an exhaustive PhD research on documentation and rationality studies of IK. The study was conducted in Dindigul district in Tamil Nadu, India. Indigenous knowledge from 12 villages in 4 revenue blocks of Dindigul district was documented. Indigenous knowledge of wetland, garden, dry land and high altitude crops was studied in four revenue blocks. Totally, 120 aged and experienced farmers, 10 from each of the 12 villages, were identified as respondents: the resource persons for IK. Indigenous knowledge on 13 crops was documented. Eventually, a total of 307 crop-specific indigenous practices and 79 general indigenous practices were selected making a total of 386 for rationality analyses. Rationality was analyzed on the basis of farmer-perceived adoption and effectiveness of the given IK. Rationality was also ascertained by scientists using a questionnaire. An adoption quotient was evolved for the purpose of assessing the adoption of IK. One other indicator, the Perceived Effectiveness Index, was constructed using systematic statistical and mathematical procedures. Thus, a statistically foolproof and objective methodology was evolved by Gandhigram to document and study the rationality of IK. However, documentation of IK is not an isolated and independent exercise. Mere mechanical, obligatory, dutiful and extractive interviews to document IK is seldom the best option. Inspired by this experiential learning, Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA & RI) in Karaikal, India deployed an educational innovation to sustain IK through scouting and documentation by students. After five years of rich experience with five batches of students, good lessons were learned from the field. One of the lessons was revelation of a systems approach to IK documentation. The systems approach enabled researchers (i) understand the scouting process in tandem with documentation, (ii) learn about the constraints in scouting, (iii) create an enabling environment for scouting, (iv) understand why some local people refuse to share and (v) learn strategies for managing themselves, the interaction and the resource person. Each of these issues has a gamut of lessons to be shared and exchanged. Eventually such a systems approach proved to be the best option in terms of the quality and quantity of IK scouted and documented. Thus, the cases of GRI and PAJANCOA & RI are success stories and worthy cases to share, exchange and scale up globally in similar bio-physical and socio-economic conditions.

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Introduction

Indigenous knowledge (IK) is the actual knowledge of a given population that reflects the experiences based on tradition and includes more recent experiences with modern technologies (Haverkort, 1995). Indigenous agricultural practices (IAPs) are an unwritten body of knowledge. There is no systematic record to describe what they are, what they do, how they do what they do, how they can be changed, their operations, their boundaries and their applications. It is held in different brains, languages and skills, in as many groups, cultures and environments as are available today (Atte, 1989). Hence, there is an immense pressure on the people of India to collect, preserve, validate and adopt IAPs so as to reduce dependence on external inputs, to reduce the cost of cultivation and to propagate eco-friendly agriculture (Sundamari and Ranganathan, 2003).

Methods of documentation

Many methods were suggested by different authors for documentation of IAPs. The International Institute of Rural Reconstruction (IIRR) (1996) suggested identifying indigenous specialists, case studies, field observation, in-depth interviews, participant observation, participative technology analysis, surveys, brain storming, games, group discussions, role play, SWOT analysis, village reflections, village workshops, flow chart, mapping, taxonomies, participatory video and photo/slide documentation. The IIRR had also reported that indigenous knowledge could be documented in the form of descriptive texts such as reports, taxonomies, inventories, maps, matrices and decision trees; audiovisuals such as photos, films, videos or audio cassettes as well as dramas, stories, songs, drawings, seasonal pattern charts, daily calendars etc. Indigenous knowledge can also be stored in local communities, databases, card catalogues, books, journals and other written documents, audiovisuals, museums etc. Karter (1993) pointed out that the verbal style of investigation does not yield satisfactory results always. He argued that observation becomes more important. He asserted further that real insight could be obtained only by prolonged observation. Chande (1993) reported that surveys, competitions and interviews help document indigenous practices. Dubey *et al.* (1993) reported several methods like the case study method, the oral history method, key informant means, making diagrams, case histories, critical incidents, preference ranking and inventory of farmers' indicators could be used for eliciting and documenting knowledge from local people. Mane and Sutaria (1993) used methods like dialogues, field observations and joint interpretations to arrive at conclusions to document indigenous practices. Rajasekaran (1993) recorded details of IK systems using farmer participatory methods such as participant observations and unstructured exchanges. Rath (1993) was of the view that the participatory approach was the method for indigenous research. Singh and Rajoo (1993) used individual and group interviews, participant observations and agro-ecosystem analysis for recording information on IK systems. Vivekanandan (1993) stated that conducting village level workshops and group discussions with farmers and artisans, publishing newsletters in the local language for the exclusive communication of traditional farm technologies and travelling to interior regions were some of the effective means of identifying, documenting and disseminating traditional technology

and were also a means of getting feedback from people. Arulraj and Vasanthakumar (1996) utilized the Participatory Technology Development (PTD) approach to identify IK and to integrate the knowledge in the technology development process. As reported by Hanyani-Mlambo and Hebinck (1996), the important sources of IK are innovative farmers, indigenous experts, opinion leaders and village elders. Kanagasabapathi (1996) concluded that methods like participant observation, individual and group interviews, field observations, joint interpretations, structured and unstructured interactions, preference ranking, case histories and critical incidents/methods play a vital role in documenting indigenous practices.

Methods of validation of IK by testing rationality

Any practice, considered valid and fruitful, will have a scientific basis for its successful results. Farmers are not able to explain the scientific rationale behind indigenous practices; therefore, scientists are responsible for testing and verifying those practices and finding out their rationality. Thus, one simple method of validation of IK has been studying the rationality of the given IK by scientists. There are few studies reporting the rationality of IAPs as perceived by scientists.

Hiranand and Kumar (1980) concluded in a study that it becomes necessary for scientists to investigate the rationality of each one of the technical beliefs held by farmers so that they can clearly accept or reject a technical belief. Padaria and Singh (1990) identified traditional dry farming practices that are being followed in the Ranchi district of Bihar and that were assessed by scientists on a five point rating scale. Among identified practices, the practices that scored a mean score of above four were considered as more rational. Many of the traditional practices are still in vogue and meet the standards of scientific rationality to a great extent. Kalaivani (1992) in her study on beliefs connected with garden land farming studied the rationality of indigenous beliefs rated by scientists. Ramaraju (1993) reported many indigenous practices that scientists considered rational. Prasad *et al.,* (1996) in their study on "Rationale of indigenous post harvest practices in Ranchi district" concluded that scientists favoured the continuation of 9 of the 11 indigenous post-harvest practices on threshing, de-husking and storage activities for rice, wheat and grain legumes followed by a sample of 200 farmers. Ganesamoorthi (2000) in his study on indigenous post-harvest practices observed that scientists rated more than 80% of the indigenous post-harvest practices as rational. Similar studies on the rationality of IK were also reported by Rambabu (1997), Somasundaram (1995) and Pulmate and Babu (1993).

Hence, testing rationality has been one of the means to validate IK.

Methods of validation of IK by testing perceived effectiveness

The effectiveness of IK has to be established and is a valid criterion by which to test its validity. Farmers perceived that local varieties of pineapple were better than the "Kew" variety because they were sturdy and tasty and withstood the stress of transport (Kanagasabapathi, 1996). It is rational and sensible to integrate IK into development, for the simple reason that it is less expensive, readily available,

environmentally appropriate and familiar, and most important of all, it has a proven record of effectiveness (Emadi, 1998). When compared with many modern technologies, traditional techniques have been tried and tested, are effective, inexpensive, locally available and culturally appropriate and, in many cases, are based on the principles of preserving and building on the patterns and processes of nature (Grenier, 1998). In South-western Nigeria, some of the forest plant products used by rural farmers were found very effective in controlling many crop pests (Apantaku, 1999). Indigenous post-harvest practices were perceived by the farm women as economically feasible and user-friendly. The indigenous post-harvest tools used by the women were made by local artisans using low-cost resources, which were locally available. They were easy to repair and to maintain and they did not require a high degree of technical skill to make (Parvathi *et al.,* 2000). Apart from the cost–benefit of the farmers' innovative practices vis-à-vis the existing practices, it is important to note the environmental consequences; the use of waste or less useful material; the ease of operation and repair, in the case of tools; gender implications etc. (Gupta, 1990). Hence, traditional tools and techniques should be studied systematically and an organized effort made to improve their efficiency and productivity (Srivastava, 1980).

Hence, studying perceived effectiveness of IK has been one of the means to validate IK.

Documentation and validation: the Gandhigram Rural Institute (GRI) approach

An intensive study (Sundamari and Ranganathan, 2003) was felt essential to collect, document and analyze the IAPs available in all the existing farming systems. Also, no such attempt had so far been undertaken to collect IAPs in high elevation farming systems. Further, no effort had so far been made to devise a methodology to study the effectiveness of IAPs as perceived by farmers. Keeping these points in view, the present study was formulated to document and analyze the IAPs in all the four farming systems, *viz.*, wetland, garden and dry lands and high elevation farming systems, with the following specific objectives:

1. To identify, classify and analyze the IAPs existing in different farming systems.
2. To analyze the rationality of the selected IAPs.
3. To develop a methodology for measuring the effectiveness of IAPs as perceived by farmers.
4. To assess the adoption of IAPs and their effectiveness as perceived by farmers.
5. To study the characteristics of farmers and their association with the adoption and perceived effectiveness of IAPs.

Of all the objectives, documentation and validation of IK by testing rationality and studying perceived effectiveness are appropriate for a form of bio-cultural dialogue for conservation of IK.

Documentation of IK: GRI's Method

The GRI survey research methodology was adopted for documentation of IK and is detailed herewith.

Locale of research

The Dindigul district of Tamil Nadu state was selected for this study. Out of the 14 blocks of the district, 3, *viz.*, Palani, Nilakottai and Reddiarchatram blocks, were selected as they possessed cultivated areas under wetland, garden and dry land crops in a higher proportion compared with other blocks. Kodaikanal block was selected to study high elevation crops. Thus, four blocks were selected in total for the study. Dindigul district is a land-locked district of Tamil Nadu state, India, and it lies between the longitudes 77' 30" E and 78' 20" E and the latitudes 10' 05" N and 10' 09" N. The district has a semi-tropical and tropical monsoon type of climate prevalent in the plains, while the hill areas record very low temperatures with fairly heavy rainfall. The mean maximum and the mean minimum temperatures of the study area are 33.91^{o}C and 22.67^{o}C, respectively. The hottest months are observed to be between March and May. The district chiefly benefits from the north-east monsoon followed by the south-west monsoon. The average annual rainfall is 836 mm, which is received during 48 rainy days mainly in the months of September to December. Soils are predominantly thin red with pockets of black soil. *Irugur* series is a predominant soil type followed by *Palaviduthi* (Sankararaj *et. al.,* 1985). This information will be useful if the research is ever replicated in similar or identical locations.

Selection of IK for documentation

Indigenous agricultural practices with respect to 13 crops, namely, rice, sorghum, black gram, cowpea, groundnut, coconut, cotton, sugarcane, mango, hill banana (indigenous), tomato, chilli and coffee were selected for further study on the basis of the following criteria.

- Area under cultivation of the individual crops in the study area
- Economic importance of the crops
- Number and importance of IAPs available for them

Selection of villages

Three villages, i.e., one for wetland, one for garden land and one for dry land crops, were identified in each of the three blocks, *viz.*, Palani, Nilakottai and Reddiarchatram, on the basis of the major area covered under the respective farming systems. Another three villages were identified exclusively in Kodaikanal block to study high elevation crops. Totally, 12 villages were chosen in all the 4 blocks selected for the study. Villages were selected in consultation with the extension workers of the State Department of Agriculture on the basis of the availability of area under the 13 chosen crops.

Selection of respondents of IK/sampling procedure

Ten farmers for each crop in each of the three blocks, *viz.*, Palani, Nilakottai and Reddiarchatram, except for coffee and hill banana were questioned. For high elevation crops, *viz.*, coffee and hill banana, it was decided to contact 30 farmers for each crop, exclusively in Kodaikanal block. Thus, the sample size was 30 respondents per crop, which added up to a total of 390 respondents for all the 13 crops chosen for the study area. However, only 161 respondents were contacted at random, since some of them were cultivating more than one crop (when respondents were selected from more than one village for a crop, they were selected using the proportionate random

sampling method, i.e., in numbers proportional to the area under cultivation of that particular crop).

Data collection tool used

Table 1 depicts the data collection tool used for documenting IK. The data collection tool used to study the extent of adoption of IAPs is a set of interview schedules. The interview schedules were pre-tested in a non-sample area and necessary modifications were carried out to overcome the difficulties encountered during pre-testing. Each of the selected respondents was personally contacted and interviewed by an investigator using the structured interview schedule. Apart from the above mentioned farmers, information on IAPs was also collected to a limited extent from secondary sources.

Table 1. Tool for data collection for different categories of farmers and IK systems

Sl. no	Purpose	Device	Type of respondents	Number of respondents
1	IK on rice	Interview schedule	Rice farmers	30
2	IK on sorghum	Interview schedule	Sorghum farmers	30
3	IK on black gram	Interview schedule	Black gram farmers	30
4	IK on cowpea	Interview schedule	Cowpea farmers	30
5	IK on groundnut	Interview schedule	Groundnut farmers	30
6	IK on coconut	Interview schedule	Coconut farmers	30
7	IK on cotton	Interview schedule	Cotton farmers	30
8	IK on sugarcane	Interview schedule	Sugarcane farmers	30
9	IK on mango	Interview schedule	Mango farmers	30
10	IK on hill banana	Interview schedule	Hill banana farmers	30
11	IK on tomato	Interview schedule	Tomato farmers	30
12	IK on chilly	Interview schedule	Chilli farmers	30
13	IK on coffee	Interview schedule	Coffee planters	30

The outcome of GRI's method of documentation

Information on a total of **1203** IAPs was collected. The IAPs were then classified systematically: 1000 practices used for 61 crops and 203 practices grouped under 13 general agriculture subheads. After deleting block specific IAPs, 307 IAPs were selected for further analysis for the 13 crops listed above. Similarly, the IAPs that were not crop specific and that were almost general and applicable to all the crops grown on the plains were also selected as general agriculture practices. Thus, 307 crop specific IAPs and 79 general agriculture IAPs were selected to make a total of 386 IAPs for rationality analysis.

Validation of indigenous knowledge: GRI's method – testing rationality

In this study, "rationality" refers to the degree to which IAPs can be explained or supported by scientific reason or established on the basis of long time experience. Likewise, "irrationality" refers to the degree to which IAPs cannot be supported by scientific background or cannot be established on the basis of experience.

For testing rationality, the selected 386 IAPs were classified into three groups, namely, production aspects of field crops (172), production aspects of horticultural crops (81) and protection aspects of all the crops (133). Three questionnaires containing the three different lists of IAPs, as mentioned above, were prepared and presented to scientists for judging the rationality of the practices. The questionnaires were referred to scientists of Gandhigram Rural University, Gandhigram; Tamil Nadu Agricultural University, Coimbatore and Pandit Jawaharlal Nehru College of Agriculture, Pondicherry. All the 3 questionnaires were initially distributed to 50 scientists in each of the respective disciplines. Details regarding the number of scientists from whom the questionnaires were received back and who were finally considered for the rationality study are presented in Table 2.

Table 2. Discipline-wise scientists referred to for rationality study

Sl. no.	Type of questionnaire	Scientists' distribution		
		Disciplines	No. referred	No. returned
1	Production of field crops	Agronomists	50	41
2	Production of horticultural crops	Horticulturists	50	35
3	Crop protection	Plant protection specialists	50	40
	Total		**150**	**116**

The following weightages (Table 3) were assigned to the responses of the scientists to judge the rationality of the practices by adopting the procedure initiated by Rambabu (1997).

Table 3. The weightages (scores) assigned to the responses of the scientists

Sl. no.	Responses	Scores
1	Rational based on scientific evidence	4
2	Rational based on experience	3
3	Irrational based on experience	2
4	Irrational based on scientific evidence	1

Mean scores were calculated for each of the IAPs, and those practices that had a mean score of 2.5 and above were identified as rational and those below 2.5 were identified as irrational.

Having identified and selected the list of IAPs with their rationality scores, further analysis was undertaken to test/verify their perceived effectiveness.

Validation of indigenous knowledge: GRI's method – verifying perceived effectiveness

Effectiveness is the capability of a material or non-material object to produce something or to lead to some consequence. However, in this study, the perceived effectiveness of an IAP was defined as the extent of the ability of that practice as perceived by farmers to solve various problems faced by them in farming.

The traits of IAPs formed the basis for working out the Perceived Effectiveness Index (PEI) of indigenous practices in this study. Twelve traits were identified using rigorous methods such as Relevancy Ratio, Test of Reliability and Tests of Validity.

Perceived Effectiveness Index (PEI)

The development of a methodology for measuring the perceived effectiveness of indigenous practices and the identification of effective IAPs for selected crops were the main objectives of this research. Hence, it was proposed to construct a PEI to identify the effective IAPs.

The selected list of 12 traits was given individually to each of the respondents, and they were asked to rate the effectiveness of each of the IAPs, adopted by them for selected crops, against each of the traits on a 3 point continuum, the points being "agree", "undecided" and "disagree" carrying scores of 3, 2 and 1, respectively.

If $R_1, R_2, R_3 \ldots R_{12}$ were the relevancy weights of the 12 traits, then the PEI was defined as follows:

$$PEI = \frac{W_1R_1 + W_2R_2 + W_3R_3 + \ldots\ldots + W_{12}R_{12}}{R_1 + R_2 + R_3 + \ldots + R_{12}}$$

where, $W_1, W_2, \ldots\ldots W_{12}$ were the scores obtained for the traits for an IAP from a respondent.

In simple terms,

$$PEI = \frac{\sum W_i R_i}{\sum R_i}$$

The maximum of each W_i would be 3 and the minimum of each W_i would be 1. Since, when $W_i = 3$ for all i,

$$PEI = \frac{3 \sum R_i}{R_i} = 3$$

and when $W_i = 1$ for all i,

$$\text{PEI} = \frac{1 \sum R_i \\ = 1}{R_i}$$

The PEI computed as above was actually the PEI for a particular IAP as expressed by an individual respondent. Hence, to obtain the Overall Perceived Effectiveness Index (OPEI) for a particular respondent, the PEIs obtained for all the IAPs adopted by him were summed up and the mean was worked out. That mean PEI was taken as the OPEI for that respondent.

Similarly, the PEIs obtained from all the respondents for a particular IAP were summed up and the means worked out. The mean PEI obtained was taken as the Mean Perceived Effectiveness Index (MPEI) for that IAP.

For the most effective IAP, the MPEI would be 3, and for the most ineffective IAP, the MPEI would be 1. A moderately effective IAP would get an MPEI of 2.

Hence, those IAPs that had MPEIs greater than 2.0 were considered as effective IAPs as perceived by the farmers and all others as less effective IAPs.

It was decided to study the perceived effectiveness of IAPs for a limited number of crops, namely, rice, sorghum, coconut and coffee representing the wetland, dry land, garden land and high elevation farming systems, respectively, and these crops were selected on the basis of the area under their cultivation in the respective systems and the number of IAPs available for them. Therefore, out of the 161 respondents selected for studying the adoption of IAPs, the list of traits for studying the perceived effectiveness of IAPs was only given to the 103 respondents who were cultivating these 4 crops.

However, it could not be expected that all the respondents would adopt all the IAPs selected for further study. At the same time, an IAP that was only adopted by a few respondents could not be termed as effective even if it had been perceived as effective by them. Hence, it was decided to analyze the perceived effectiveness and to calculate the PEIs only for those IAPs that were adopted by not less than 50% of the respondents selected for studying their adoption behaviour for the four crops, *viz.*, rice, sorghum, coconut and coffee. Thus, PEIs were worked out only for 75 IAPs for these crops.

Thus a statistically foolproof and objective methodology was evolved by Gandhigram for documentation and validation of IK.

Scouting and documentation: PAJANCOA & RI's experience

Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA & RI) in India deployed an academic mechanism to sustain IK through scouting and documentation by student-researchers. The Society for Research Initiatives and Sustainable Technologies and Institution at the Indian Institute of Management in Ahmedabad (IIMA), India rendered financial assistance (Anandkumar and Kumarakurubaran, 2004). One hundred and eighty-two students scouted for IK from

1998 to 2003. Apparently, only 345 days out of this 5-year period were used for this project. Actually, the study of IK was not a full-time activity. Students scouted for and documented IK only during their leisure time, as and when there was an opportune moment and when resource persons were accessible on the sidelines of their Rural Agricultural Work Experience programme. After five years of rich experience with five batches of students, good lessons were learned from the field on how to scout for and document IK effectively and efficiently. These experiences are documented here for exchange and scaling up.

Constraints in scouting for IK

There are many constraints that researchers face while scouting for IK. The lack of information on constraints could puzzle researchers on what prevents them from finding and hence documenting IK. Hence, some experiences of the constraints in scouting for and documentation are given below:

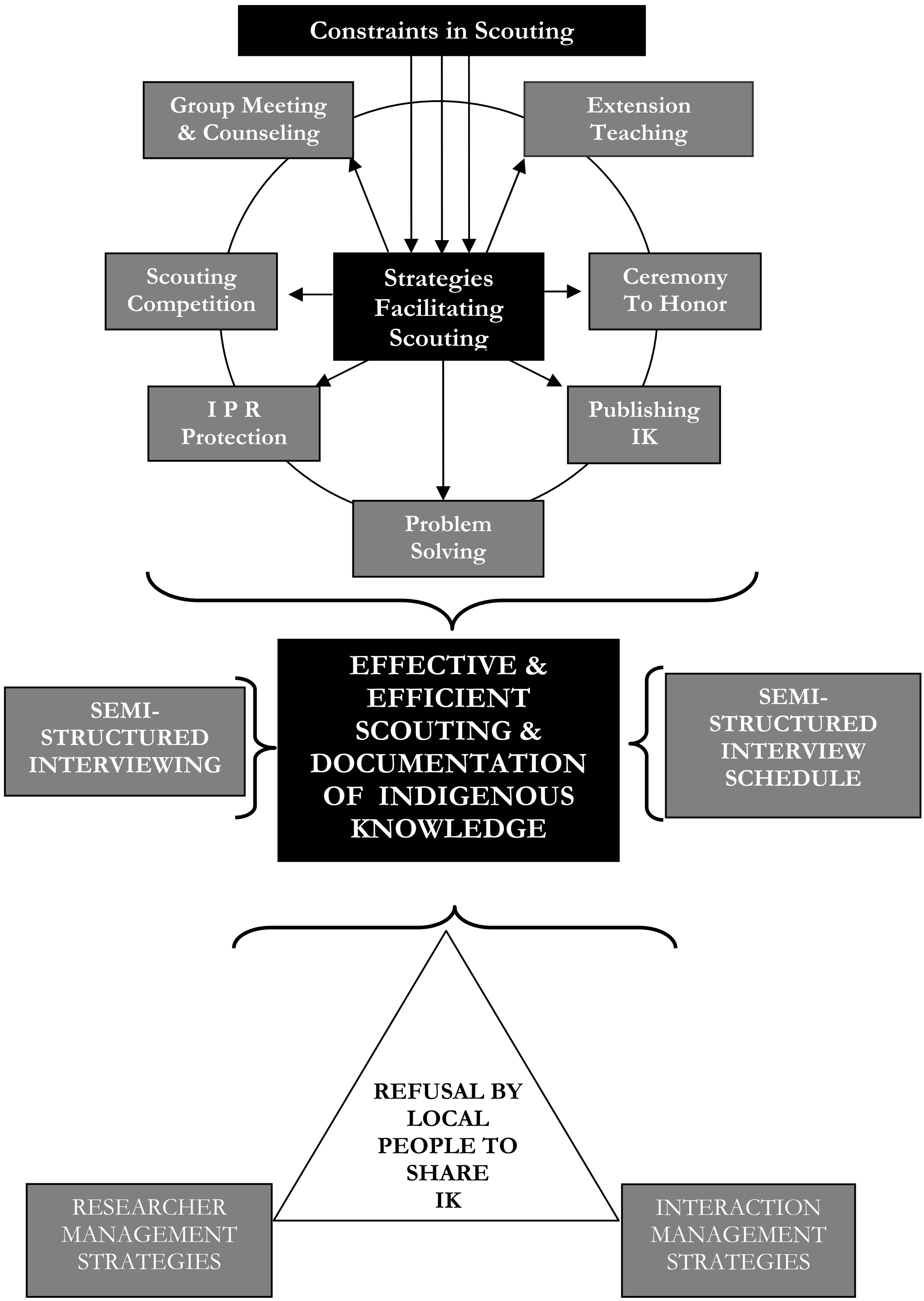
1. Difficulty in finding resource persons (local people) who possess IK.
2. Availability of IK in a village is limited by the extent of modernization in it and its proximity to an urban area.
3. Local people might be prejudiced against officials dealing with land records or income tax and hence might be wary of IK researchers too.
4. Researchers may be unable to understand the dialectical nomenclature used by local people to describe plant species.
5. The local language used by resource persons to describe IK can at times be incomprehensible to researchers, and hence, it can be difficult to document IK.
6. Researchers at times do not have adequate information on the strategies required to scout IK.
7. Many local people refuse to divulge IK, and hence, it is difficult to scout for it.
8. Some local people find it difficult to understand the concept of IK as perceived by researchers.

However, once such constraints have been experienced, a few strategies emerge as a natural response.

Strategies to facilitate scouting for IK

Strategies to make searching for IK easy are suggested here. These strategies were found to create an environment conducive to scouting for IK. They are

1. Conducting *peripatetic group meetings* in order to promote awareness and to motivate local people to share IK often works well. Appropriate counselling ensures that local people do not get ensnared by vested interests.
2. Using *extension teaching methods and aids* helps educate local people about the importance of IK and hence documentation.
3. Arranging *scouting competitions* for local people (women, farmers and children etc.) and selecting winners for awards for aiding scouting of IK.
4. Informing local people well in advance regarding the *rewards/incentives* for outstanding innovators could motivate local people to share IK.
5. Holding *public ceremonies* to honour innovators by a reward/award could be useful. This could inspire local people to share IK.



How to scout & document indigenous knowledge: A paradigm

6. Informing local people about *publishing documented innovations* of local people in newsletters/journals acknowledging the identity of the innovator(s) and popularizing their innovations.
7. Communicating to the community the possibility of obtaining *intellectual property rights* for IK and equitably sharing the benefits accrued through commercialization with the innovator/local people.
8. Conducting location specific peripatetic group meetings, demonstrations and farm and home visits in order to address local people's problems and priorities (e.g. insects, diseases) could oblige local people to reciprocate by also sharing their IK.

Despite identification of resource persons as result of the strategies enabling scouting, IK may still be difficult to get as many of the resource persons may refuse to share their IK.

Reasons for refusal to share IK

Many members of a community often refuse to share IK. Some of the reasons for refusal experienced by researchers are documented here. Thus, researchers can be aware why some community members refuse to speak about their IK. Consequently, researchers can prepare themselves to manage refusal during documentation of IK. Some of the reasons resource persons refuse to share their IK:

1. Owing to exclusive ownership, they prefer not to share the benefits of their own findings (IK).
2. They are reluctant to disclose their IK owing to competition in business (e.g. health counselling).
3. They may feel that others will exploit the shared IK to their advantage and to the disadvantage of the innovators.
4. The belief that ethno-medicines become ineffective if shared.
5. There is a practice of sharing IK only with legal heirs and not with outsiders.
6. They may feel insecure, fearing the loss of social respect once their shared IK becomes common knowledge. Hence, the inventors/resource persons may feel that they will lose their specialty in their social context.
7. They do not share IK if the researcher is unfamiliar or naïve.
8. They may suspect that researchers may steal their innovations and make money using their IK.
9. They may perceive researchers as a hindrance to their commitments and chores.
10. They may assume that researchers are officials dealing with land records or income tax and so evade them.
11. They may make the assumption that a fully informed researcher is testing their knowledge and is actually well-informed about the IK.
12. There may be no incentives or rewards for revealing IK.
13. They may be shy to speak about IK, fearing that they will be considered uncivilized in these modern days.
14. They may be unaware that their contribution is noteworthy and respectable.
15. They may place no special importance on IK, treating it as part of the vicissitudes of life and farming.
16. They may fear that others may adopt their innovations.

17. They may fear being penalized or prosecuted by authorities since their IK is unapproved or unlicensed.
18. They may wish to prevent the youth (researchers) from "wrongly" using the practices (e.g. contraception).

Once the reasons for refusals are known, the next step is to find ways to enable reluctant respondents to share their IK so that the researcher can document it.

Strategies to manage refusals

Field experiences have suggested some strategies to help researchers manage the refusal by local people to share their IK. The strategies are classified into three types, *viz.*,

1. **Researcher management strategies:** How should researchers manage themselves to manage refusals?
2. **Resource person management strategies:** How can resource persons be managed to manage refusals?
3. **Inquiry management strategies:** How can the process of asking questions be managed to manage refusals?

1. Researcher management strategies

The onus of these strategies is on the researchers as they require researchers to make changes to themselves. The strategies are given below.

1. Make a proper self-introduction and make the purpose of the visit clear to the local community.
2. Good conduct is of paramount importance.
3. Always be humble and submissive.
4. Demonstrate hard work in the field. Hard work could convince local people about your commitment to learn the resource person's knowledge.
5. Dress simply. Be close to the culture of local people in dress.
6. Use local language equivalents to all those terms normally expressed in English. And talk to farmers in the local language only.
7. Be a "yes-man" for quite some time at the beginning of an inquiry about IK. Try hard not to ask too many questions in the beginning. Also refrain from debating culturally different IK.
8. Good rapport is vital for the eliciting of IK.
9. You will need plenty of patience while documenting IK. Strong determination is essential for overcoming discouragement while scouting. Scouting is often horribly discouraging.

2. Resource person management strategies

These strategies could come in handy for researchers trying to manage reluctant resource persons better. Such people management strategies place the onus of effecting change on the resource person. These strategies are given below:

1. Find the right time for making inquiries by consulting the local people from whom IK is to be obtained.
2. Accompany local persons familiar/known/related to resource persons in order to get introduced to them before making any inquiries.

3. Make frequent (repeated) visits for inquiring or getting appointments with resource persons as this helps convince them that you are committed to learning about the knowledge.
4. Listen to what resource persons have to say even if it may not be interesting. This impresses resource persons and will enable you to better elicit IK.
5. Promise traditional healers that the confidentiality of shared IK will be maintained and that their identities and contributions will certainly be acknowledged.
6. Inform resource persons that their innovations could be published, that they could get patents in their favour and that they could gain recognition among the public for their innovations.
7. Tell resource persons that they are important as they are informal scientists in the emerging endogenous development paradigm.
8. Many resource persons aspired "to be interviewed" because it is a boost to their self-esteem (celebrity craze). Hence, you can impress resource persons by saying, for example, "*I have come to interview you especially.*" Then, you could say, "*I would like to write down what you say for it is really interesting and new to me*". This could enthuse them to share IK.
9. Farmers with big farms also have the ability to share IK. They may not be very preoccupied as they engage labourers. Moreover, they may better comprehend the content and intent of IK. Hence, these farmers can also be referred to while scouting for IK. Some researchers tend ignore big farms.
10. If the resource persons are out of station, ask members of their household about IK, provided you have a good rapport with them. This avoids loss of time due to absenteeism of the intended respondent. The whole-family approach is worthwhile for scouting.
11. Smile, greet and acknowledge resource persons who have shared IK in the past as this could encourage resource persons to share more information.
12. Resource persons should not get physically exhausted by sharing IK. Stop an inquiry after 20 to 30 items of IK have been documented. Get an appointment from the resource person for some other day.
13. Many aged women have protracted nut-cracking and betel-chewing sessions. These are relaxed occasions for sharing thoughts and ideas on destiny, proposals, fortunes, fortitudes, bad luck and the past, present and future. Try and capitalize on such opportune occasions. Offering betel leaves may be the catalyst needed to enable the sharing of IK by such aged resource persons.

3. Inquiry management strategies

These strategies help researchers manage the inquiry process better. Such process management strategies place the onus on the interaction between the resource person and researcher. These strategies are given below:

1. Explain yourself thoroughly to local people by answering the five common but important queries usually raised by them when people come and scout for IK, *viz.*, "What is IK?", "Why are you asking about IK?", "What benefit do you get?", "What benefit do we get?" and "Will you acknowledge my contribution?".
2. Present some cases or success stories of innovators of IK in order to enable resource persons to comprehend, recollect and articulate.

3. Present the cases of the piracy of turmeric, philanthus, basmati rice and neem with all their detrimental implications to the community.
4. Do not mechanically treat IK as a commodity and hence chase resource persons. Instead, engage in informal discussions, gently talk about IK and while talking gradually thread in questions on IK.
5. Walk casually through the village to interact with local people in village to explore IK.
6. Go to the farms/fields directly and ask the purposes of a given entity (probable IK).
7. Ask people to give details about any material/implement/technology/solution that has not been seen hitherto.
8. Ask the question "What practices did you follow before changing to a material/implement/technology/ solution suggested by an advisory service?"
9. Discuss natural farming or farming done in the olden days (60 to 70 years ago). Take a lead in the discussion, ask about practices that are "not" modern or formally scientific and are hence indigenous.
10. Ask (may be by giving some examples) about ancient practices followed by ancestors.
11. Ask whether resource persons modified any recommendations of an advisory service to make it more appropriate to their requirement or need or problem.
12. Ask how resource persons managed problems (list problems one by one) in their own way.
13. Ask the question "What are the "easy" methods you follow when you suffer from fever/cough etc.?".
14. Ask the question "What home remedies do you try to cure a disease before going to hospital?".
15. Ask what practices the resource person follows to cure each disease encountered.
16. Ask about practices followed by the resource person to address ailments of various parts of the body (ask about each part individually).
17. Some student-researchers when they actually had different ailments sought from local people the ethno-remedies for these ailments and then tried them out. This was a way of "learning by being for documentation". Impressed by such cases, a few other student-researchers even simulated similar circumstances in order to learn IK from local people for documentation, conservation and sustainable utilization.

Some of the strategies suggested might appear simple but are important in the context of IK. Or some may go against the values of a researcher. Some strategies may seldom be valued. Notwithstanding these reservations researchers may have, these practices were found to be determinants of effective scouting and documentation of IK. These strategies emerged as the best option. If researchers abide by these strategies, they can break the silence of the local community. Thus, documentation of IK, which is otherwise hard, will be made easier.

Having found the resource persons and after enabling them to also share their IK, the next step is to put the information learned on record as a document. How is this to be done?

A semi-structured interview schedule for documenting IK

Many "guidelines" may be available for the documentation of IK. However, detailed interview schedules to document IK are scarce. A comprehensive semi-structured interview schedule to explore any given IK is described herewith. Many questions were framed to explore various essential facets of any given IK. Answers to questions could reveal exhaustive and useful information. This information will expose the great potential of any given IK and is essential for scaling up and for enabling it to be protected as intellectual property. This semi-structured interview schedule is a comprehensive data collection tool for documenting IK by bringing on record its dynamics, utility and legitimacy. The semi-structured interview schedule is given in Annexure 1.

Outcomes of PAJANCOA & RI's approach

Adoption of these strategies and tool has resulted in amazing outcomes at PAJANCOA & RI.

- Nearly 20,000 indigenous practices (with, of course, multiple responses) were scouted for and documented.
- Hundreds of local people were reached and sharing by them was ensured.
- Every innovator or custodian of IK was acknowledged and endorsed in order to prevent impoverishment, piracy and to reward creativity. Moreover, every local innovation was identified by its innovator or custodian.
- Every student-researcher was also acknowledged.
- About 50 cases of very successful indigenous technologies were documented in detail using the semi-structured interview schedule. One such example can be found in "*ILEIA India"* magazine (Anandkumar and Kumarakurubaran, 2004).

These outcomes have validated this approach as the best option for scouting and documenting IK.

Lessons learnt on documentation

Documentation of IK is not an isolated and independent exercise. This will seldom be the best option. But understanding scouting in tandem with documentation, knowing the constraints in scouting, creating an environment that enables scouting, exploring why local people refuse to share and researchers managing themselves, the interaction and the resource person all have a part to play in the effective and efficient documentation of IK. Eventually, such a systems approach (as shown in the paradigm) proved to be the best option in terms of the quality and quantity of the IK scouted for and documented. The very successful experience of PAJANCOA & RI in scouting and documentation is a worthy case to share, exchange and scale up for conservation and sustainable utilization of IK.

Annexure - 1

1. Title of the IK
Title should reflect 'What, Why, Where, When, and How'.
2. Acknowledging innovator / disclosing the source
i) Name of the innovator **ii)** Father's Name **iii)** Address of the innovator **iv)** Phone Number / E mail Id. **v)** Any other contact number / address **vi)** Caste / Religion / Ethnic group / Community **vii)** Profession and Occupation(s) **viii)** Age (as on.…) **ix)** Education
3. Description of the technology
i) What are parts / components / ingredients / raw materials required? Mention each and every part / component / raw material / ingredient clearly and fully. **ii)** What are the measurements / dimensions / quantity of each and every part / component / raw material/ ingredient? **iii)** What are the functions/purposes of each & every part/component/raw material/ingredient? **iv)** What method / procedure is involved in preparation / fabrication of the IK? Describe step by step, the method involved in the IK. Concentrating on every minute aspect involved in the method / procedure / function of IK. Not to leave any point, even when it may appear silly, simple, small and cheap to you. However, it may be critical.
4. Indigenous aspects
4.a. *Specific local conditions that prompted invention of IK* **i)** What were the *conditions* / *compulsions* responsible for inventing the IK? **ii)** What were *situations* responsible for inventing the IK? **iii)** What were the *reasons* for inventing the IK? **iv)** What were the *causes* or what *stimulated* the resource person to invent the IK?

4.c. *Novelty / Uniqueness*

i) How many people possess or adopt the same IK?

ii) Is innovator the only person to innovate / possess the IK?

ii) Has it been published / publicized any where?

iv) Is it available anywhere else?

4.d. *Traditionalism*

i) How long the IK was in practice?

ii) Was it practiced regularly or as and when required?

4.e. *Local knowledge*

i) How the resource person learnt the IK?

ii) How and from where the resource person obtained the knowledge of the given IK

4.f. *Common problems addressed*

i) What are the problems solved by the IK

5. Sustainability of the IK

5.a. *Economic sustainability of the IK*

i) What is the cost of raw materials / components / parts / ingredients?

ii) What is the cost of manufacturing / production / fabrication of the IK?

iii) What is the cost of annual maintenance/repair and cost of spares/components?

iv) What is the usual profit with the normal practice (without adoption of IK)?

v) What is the additional profit due to adoption of the IK?

vi) What are the non-monetary profits (profits other than money) due to adoption of IK?

vii) How the IK can be made more profitable and also practiced for many years.

5.b. *Environmental Sustainability of the IK*

i) Is there any harm to human or to any other organisms due to the IK?

ii) Is there any damage to air / atmosphere due to the IK?

iii) Is there any damage to ground or surface water sources due to the IK?

iv) Is there any damage to soil due to the IK?

v) Whether given IK increases or decreases environmental crisis?

vi) Whether given IK depletes or conserves natural resource base (Land, biodiversity etc)?

vii) Whether the given IK depends on renewable or nonrenewable source of energy?

viii) How the IK can be made more environment-friendly?

5.c. *Social sustainability of the IK*

i) Whether farmers / public would accept and adopt the IK? Why? How?

ii) Whether farmers/ public would reject / oppose the IK? Why? How?

iii) Whether farmers / Public continue to use the ITKS on long term? Why? How?

iv) What should be done by authorities to enable others adopt and continue to use the IK?

6. Strengths of the IK

i) What are the *exclusive benefits* due to the IK (not present with other practices/equivalents)

ii) What are the *exclusive advantages* of the IK when compared to other equivalents?

iii) What are the *positive impacts* due to the IK?

iv) What are the *visible impacts* due to the IK?

7. Weaknesses of the IK

i) What are the disadvantages of the IK?

ii) What are the negative aspects of the IK?

iii) What are the limitations of the IK?

iv) What are the criticisms expressed by others about the IK?

v) How to convert the weakness into strength?

8. Success of the IK

i) On what basis the innovator says the IK is successful?

(Get as many numbers of visible evidences and witnesses to prove the success of the IK)

ii) How the success of the IK can be proved in quantitative terms?

iii) How the success of given IK can be proved in qualitative terms?

9. Potential for replication

i) Is it possible to use / adopt the IK in other places? Why? How?

10. Period

i) When the IK was invented?

ii) How long was in use?

iii) When it had been discontinued? Why?

iv) What to be done to continue the adoption?

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Traditional Agricultural Practices for Crop Protection – Testing and Validation

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Abstract

The increase in the use of pesticides in the past two decades has led to several problems such as environmental degradation, health hazards for humans, pest resistance and resurgence and decrease in the population of beneficial insects, which has a direct impact on pest management. In ancient days, farmers used fruits, leaves and the bark and roots of various plants like neem, pongam etc. for pest and disease management. The Vrkshayurvedic texts provide information on various traditional pest management practices that involve mechanical, agronomical and biological methods.

Our studies on and experience of traditional plant protection are presented here. We show the contemporary relevance of certain folk practices. The Ayurvedic approach was followed in the preparation of biopesticides such as arkam, kashayam, asavam, thailam, arishtam etc. from plants. Experiments were conducted both in the laboratory and in the fields on different crops to test the efficacy, dosage and shelf-life of biopesticides. Fumigation was an age old practice for disease management in crops. We have tested the same using different plant products and have obtained promising results. This paper presents our experiences on the application of Vrkshayurvedic principles to present day problems in agriculture.

In ancient days and prior to the Green Revolution, farmers in rural areas were practising a wide range of traditional techniques for pest and disease control. Some practices were supplemented with religious ceremonies and rituals. A few examples are given below.

- The festival *Karthigai Deepam* is celebrated during the months of November–December wherein there is community lighting of lamps during the evening hours. This serves as a bonfire for the pests that attack the samba crop (sown in Aug–Sept) that will be at its peak vegetative phase during this period (Nov–Dec) and is highly prone to pest attack.
- *Mulaipaari* (germination test) is done in the month of *Adi* (July). People in the villages take a handful of seeds of the different varieties of crops that they are interested in sowing that particular season and place them in a pot for germination. This is left in a temple for four to seven days after which the pot is carried round the temple. The seeds that have germinated better are chosen for sowing in the following season. This serves as a germination test for different seeds.
- *Pon yeru kattuthal* is done on the first day of *Chitirai* (which usually falls on April 14th). The *yeru* (plough) is worshipped, decorated and taken to the field where the first ploughing is done. This incidentally falls during the peak of summer, and this summer ploughing brings the resting stages of pests like pupa to the surface

where they are destroyed either by the hot sun or are picked up by predatory birds.

Many such practices are on the verge of extinction owing to the Green Revolution and the quest for increasing food production to meet the demands of the growing population.

However, these traditional methods are simple, cost effective, eco-friendly and can easily be adopted by farmers. They can be broadly grouped as under:

1. **Mechanical methods** involve the mechanical removal of pests. For example, hand-picking the larvae and grubs, removing eggs from the tips of the leaves by pinching off the terminal portion, warding off birds that damage grains using effigies or by producing noise using drums, controlling pests by dusting ash on the plants etc.
2. **Agronomical methods** include various methods like intercropping, trap cropping, border cropping, crop rotation, fumigation, use of light traps, use of bird perches etc.
3. **Biological methods** involve the use of parasites, predators, botanical pesticides etc. for crop protection.

Traditional technologies – a few examples

1. Use of bonfire (light trap)

Light traps can be used to monitor and trap adult pests thereby reducing their population. Some common forms of light traps used are bonfires (traditional method), electric bulbs and hurricane lamps. A large plate or vessel containing kerosene mixed with water is placed near the light. The light trap should be 2–3 feet above the crop canopy. The trap should be set up in the field between 6–9 pm. After 9 pm., there are chances of beneficial insects getting trapped. Adult moths, which are attracted by the bright light, fall into this water and die.

2. Bird perch

The bird perch method involves the use of certain structures that invite birds to the fields when the larval population is high. 'T'-shaped bird perches can be erected in the field at the rate of 15–20 per acre. Turmeric powder mixed with rice can also be placed on the perches to attract the birds. They should be one feet above the crop canopy. These perches serve as resting places for the birds that feed upon the larvae in the fields.

3. Intercrops/trap crops/border crop

A suitable crop that will act as a trap or susceptible host should be planted along with the main crop. This crop will invite the pests and thereby the main crop can be saved to a great extent from pest infestation.

4. Fumigation

Fumigation is the traditional method in which the smoke from certain natural products is used to control diseases especially in vegetable crops and to ward off pests in storage godowns. Fumigation is the process of application of a gas, vapour or

smoke to seeds and plants for the purpose of disinfecting or destroying pests. Generally, fumigation is done in storage areas and also in the fields. Sweet flag (*Acorus calamus*), vaividangam (*Embelia ribes)* and turmeric (*Curcuma longa*) are a few of the natural products commonly used for fumigation.

Fumigation experiment: Effect of fumigation using vacha and vaividanga on tomato seeds

Materials: The materials used were vacha (*Acorus calamus*) and vaividanga (*Embelia ribes*) on potted tomato plants.

Methodology: The seeds were soaked in milk and dried in the shade, and some seeds were fumigated (i) with vacha alone, (ii) with vayvindanga alone or (iii) with both and (iv) one set of seeds was maintained without any fumigation. The above four treatments were repeated on seeds that had not been soaked in milk. Parameters like number of seedlings, root length, shoot length and chlorophyll content were recorded.

Results: Soaking the seeds in milk and fumigating them with vacha increased their germination rate, and they also showed resistance to fusarial wilt.

Note: The above experiment was carried out by B.Sc. (Botany) students of Stella Maris College, Chennai.

Fumigating apparatus

CIKS has designed a fumigating apparatus for its experimental work. It has the dimensions 3’ × 2’ × 2’ and is made of iron, with two sieves fitted at 10 and 20 cm from the top, to hold the seeds. It is fitted with hollow perforated pipes through which the fumes enter. It has a blower, heater and a fumigator. The blower is hand operated and used to blow air to the heater. The heater is used for producing fumes using the fumigants. The fumigator is a bin-like structure in which the seeds for fumigation are placed.

5. Use of botanicals or biopesticides – a few examples

Neem kernel extract

One acre of land requires 3–5 kg of neem kernels. The outer seed coat should be removed before use. The kernels should be pounded gently and placed in an earthen pot to which 10 litres of water should be added. The mouth of the pot should be tied with a cloth, and the pot should be kept aside for three days and then the contents should be filtered. On filtering, 6–7 litres of extract can be obtained. The shelf-life of this is about one month. Three to eight month old seeds should be used.

Neem cake extract

One acre of land requires 5 kg of neem cake. The neem cake should be powdered well and placed in a cotton cloth and tied. This should be immersed in a vessel containing 10 litres of water for three days. Later, the pouch should be squeezed well into the water. About 7–8 litres of extract can be obtained.

Note: One litre of the above extracts should be used in a tank with a 10-litre capacity, i.e., it should be diluted with 9 litres of water before spraying. Khadi soap solution (@ 100 ml/tank) should be added to help the extract stick well to the leaf surface. The concentration of the extract can be increased or decreased depending on the intensity of pest attack.

Examples of plants used as biopesticides

Common name	***Scientific name***
Adhatoda	*Adhatoda zeylanica*
Asafoetida	*Ferula asafoetida*
Chilli	*Capsicum annuum*
Sida	*Sida acuta*
Garlic	*Allium sativum*
Ginger	*Zingiber officinale*
Milk weed	*Calotropis gigantean*

Table 1. Examples of a few promising biopesticides

Name of the preparation	Crops tested	Effective against
Adhatoda, *pudhina, triphala kashayam*	Paddy, vegetables	Leaf folder, bacterial leaf blight, Helminthosporium leaf spot
Andrographis and sida *kashayam*	Vegetables	Aphids and borers in brinjal and okra
Barley, sesamum, horse gram *kashayam*	Vegetables	Acts as a yield enhancer
Cow's urine and sweet flag *arkam*	Paddy, okra, chillies	Bacterial leaf blight, Helminthosporium leaf spot, vein clearing, fusarial wilt, ripe rot
Garlic *arkam*,	Paddy	Leaf folder, bacterial leaf blight, Helminthosporium leaf spot
Panchagavyam	All crops	Growth promoter and provides resistance against diseases
Need seed extract	All crops	Leaf folder, aphids, jassids, fruit borer and stem borer

Five leaf extract	All crops	Jassids and borers
Ginger, garlic, chilli extract	All crops	Hoppers and borers

Advantages of storage forms of biopesticides

- Availability of raw materials is seasonal
- Raw materials are not available in all geographic locations
- Products are readily available and user friendly

Ayurvedic preparations

The biopesticides were prepared on the basis of our research, using the Ayurvedic approach. *Kashayam* (water extract) and *arkam* (distillate) are widely used for research currently. Preparations like *thailam*, *ksharam* and *phandam* are also under trial.

Advantages of the Ayurvedic approach

Biopesticides are prepared using traditional medical technology, and they have the following advantages.

- They are low cost preparations and require less investment.
- They do not cause any form of pollution.
- Neither high temperatures nor corrosive solvents are required during preparation.
- The technology for the preparation of *kashayam*, *thailam* and *arishtam* is widely known in India.
- They have a good shelf-life.
- The preparation process does not need any expensive equipment nor does it involve complicated technology.

Shelf-life of some Ayurvedic formulations

Swarasam	-	3–4 hours
Kashayam	-	24 hours
Arkam	-	1–4 years
Asavam		3–4 years
Arishtam	-	3–4 years
Thailam	-	6 months to 3 years
Ksharam	-	several years

Preparation of storage forms as per the Ayurvedic approach

We have tested out the preparation of the following forms, namely, *kashayam*, *arkam*, *phandam*, *asavam*, *arishtam*, *thailam* and *ksharam*. *Kashayams* can be prepared in a concentrated form and their shelf-life can be increased to at least three months using 1% sodium benzoate, which is a food grade preservative used in the Ayurvedic drug industry. *Asavas* and *arishtas* are preparations that take a long time to prepare since there is a fermentation period of about 40 days. *Thailams* cannot be used at higher concentrations since the oil is not miscible with water. *Arkams* and *kashayams* are currently being used in various trials. Experiments with *ksharams* have just commenced.

Comparative costs

Biopesticides are cost effective and eco-friendly. For example, to control bacterial leaf spot, leaf folder and leaf blight in paddy, the cost of chemical treatment (for 1 acre) using Monocrotophos, Endosulphan, Ekalux, Malathion and Bavistin is Rs.1,575. The cost of control using the above biopesticides is given below:

- Neem kernel extract - Rs.300 (10 litres)
- Five leaf extract - Rs.300 (10 litres)
- Chilli ginger garlic extract - Rs.350 (10 litres)
- Total cost - Rs.950

Difference = Rs.1575 - 950 = Rs.625 (includes the cost of raw material, fuel and labour).

6. Use of Panchagavyam

Panchagavyam is a plant growth regulator that in recent days is becoming popular among farmers. It is a combination of five products obtained from the cow and is extensively used in traditional medicine. The materials include dung, urine, milk, curd and ghee. It has been experimented on by CIKS, and farmers' experiences have also been documented. It plays a significant role in providing resistance against disease and pests and in increasing overall yield.

Conclusion

These age old techniques that have evolved through generations are very precious and should be protected from extinction. They are safe for the environment and the community. Considering their importance and immense potential, further research and validation becomes highly essential at this point. Research institutions and NGOs have a major role to play in reviving these techniques and putting them back in place among the farming community.

Endogenous Development in Tribal Agriculture

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Abstract

The North-eastern Ghats of India, covering 3 states, is abode to a population of about 6.5 million tribals, representing 45 groups. The backbone of a tribal subsistence-based economy is agriculture. On the basis of their anthropological racial backgrounds and the topography and ecology of the area, tribals have adopted diverse agricultural practices in the Ghats. They practice mainly three types of agriculture, which are mostly mixed types except in the case of wetland crops such as rice. Tribal agriculture practices are mostly based on their world-view, beliefs and indigenous knowledges.

Tribal traditional village council functionaries – the custodians of indigenous knowledge and world-view practices – play a big role in agricultural development. They have evolved and adopted several mechanisms for land, soil and crop management including natural pest control, botanical pesticides and organic farming practices by using indigenous knowledge and also by performing and practicing related world-views. There are different categories of tribal healers. The healers responsible for crop health are called "Taas Guniyas", and they help the community take care of crop health by using herbal medicines and mantras and by performing rituals.

Modernization and the introduction of mono crops and cash crops with hybrid seeds and other external inputs for crop management are adversely affecting tribal traditional agriculture, related knowledges and world-view practices.

Integrated Development through Environmental Awakening (IDEA) has been promoting the endogenous development concept in the tribal belts since 1995 and reviving and integrating indigenous knowledges with modern knowledges.

Introduction

The Eastern Ghats is one of the major natural resource bases of India and is the homeland of about 60 tribal communities with a population of over 11.5 million. The North-eastern Ghats, covering Andhra Pradesh, Western and Southern Orissa and Chattishgarh, is the homeland of about 6.5 million tribals, representing 45 ethnic communities from 3 racial and 4 linguistic groups. Most (80%) of these tribal groups live in inaccessible mountain valleys, hilltops and in plain forest areas with diverse lifestyles and eco-cultural practices based on their beliefs in nature, world-views and indigenous knowledge. The tribal economy is mostly agro-forest based, which is a subsistence type of economy. While agriculture and animal husbandry are the major economic bases for land-owning families, animal husbandry and the collection of minor forest products, herbs and non-timber forest products are the major income sources for marginalized and landless families.

Tribal agriculture

The backbone of a tribal subsistence-based economy is agriculture. On the basis of the topography, agro-ecology and their racial and cultural backgrounds, tribals have adopted diverse (sometimes area and community specific) agricultural practices with their time-tested indigenous knowledges and technologies and have integrated several related world-view (spiritual) practices.

The tribes of the North-eastern Ghats mainly practice three (specific to the Koraput–Visakhapatnam area of the Andhra–Orissa border) types of agriculture. These are

1. Shifting cultivation (Podu/Dongor Marbar/Lankapad senad)
2. Terrace cultivation (Tinn/Jolabedda)
3. Plain land agriculture (Digudu Podha/Pallam/Metta)

Shifting/slash and burn cultivation

Shifting cultivation is the major subsistence economic base of the tribals, especially the mountain and valley tribes. The fallow period of the shifting cultivation patches that in the last two decades used to last for about six to seven years has come down to a mere one to two years. However, the practice of shifting cultivation is not only an economic pursuit but is also a way of life for many mountain tribes. The practice of shifting cultivation accounts for their social structure, political organization, economy, culture and religious identities. Traditionally, shifting cultivation was considered a property of the community/clan. Traditional village institutions and clan heads regulated the use of forests for shifting cultivation by the individual farmers in the community. This tradition is lost owing to several socio-economic and political reasons.

Indigenous knowledge and regulations related to shifting cultivation

1. The selection of the shifting cultivation patches/areas on the mountain is the responsibility of the traditional village councils, clan heads and senior farmers. This is done on the basis of certain traditional selection criteria such as **ecological** assessment of the density of the vegetation (normally the patches with vegetation such as bushes and creepers and moist soil are considered best for shifting cultivation), **cultural assessment** (the forests or mountain should be inhabited by the mountain gods/goddesses such as *Dongor Devatha*, *Dharani Devatha* and the Seven Sister goddesses etc; the tribal priests perform a ritual and obtain the permission from these forest deities to commence mountain farming) and **economic** factors (the proposed patch should be large enough to be shared between the individual farmers). From among these three components, more consideration is given to ecological and cultural aspects. If ecological and economic components are favourable but cultural considerations are not, the tribals consider the other two components meaningless. This shows the value the tribals attach to their world-views and the spiritual world.
2. Once the selection is over, the decision on the general layout of the land management system is decided on the basis of the size and topography of the hill.

Generally, forest cover on the top of the hill is left untouched. Depending on the gradation of the hill, either vertical or horizontal plots will be divided. On the basis of the plot design, individual farmers can plan their cropping patterns and land soil management practices.

3. Once these technical considerations are taken care of, the tribals celebrate a festival known as *Pushya Parob* in the months of December–January and distribute the land to the clan heads for further distribution to their clan members. While distributing the land, the village council also suggests certain protocols related to extent of land, types of species of trees to be left in the shifting cultivation patches etc. Community members are also given advice on different types of land and soil and on cropping pattern management.
4. The traditional village council heads view seriously the violation of the protocols related to technical considerations such as socio-cultural regulations by the individual members and clans.
5. Mixed crops are the traditional crops grown in the shifting cultivation patches. However, depending on the type of design of the plot, a cropping pattern will be suggested. For example
    - In wider horizontal sloping plots, cereals, millet, beans and vegetables can be grown.
    - In vertical plots, different crops can be grown at different altitudes, for instance, sweet orange (*kamala*), lemon (*nimma*) and custard apple (*seethaphal*) can be grown on the upper part; ginger, sweet potato, turmeric and yam species can be grown in the lower part and cereals, pulses and millets can be grown in the middle part.

Traditional land classification

Depending on the soil type, the traditional shifting cultivation patches are classified into (tribes of Koraput and Andhra–Orissa border):

1. Arengbur : A land with large boulders and soil that is very hard
2. Jalengbur : A patch with rocky soil but that a hoe can penetrate
3. Jakupbur : A land with scattered stone slabs, which are not removable
4. Takup : A land dominated by stones and a depth of considerable soil in between two large stones
5. Ragudibur : A land characterized by fragile red chips mixed with soil

On the basis of the soil types, crop selection is made. Traditional village council heads such as *Disari* and *Pujari* and senior farmers will advice farmers on these technical aspects.

Terrace cultivation

Terrace cultivation is carried out in the valleys where there is perennial or seasonal water available. Unlike shifting cultivation, the selection process and the ownership of the terrace cultivation is retained with individuals or a clan.

The practice of terrace cultivation involves mostly terrace bunding using indigenous technologies, for example, land and soil management practices adopting indigenous knowledge such as application of farmyard and green manure, mulching and weed management practices. Crops grown in these lands are mostly mono crops

such as traditional rice varieties in the kharif season and vegetables and pulses in the rabi season.

Plain land cultivation

Plain land cultivation is of two types:
1. Dry plain or undulated land cultivation
2. Irrigated or rain-fed wetland cultivation

These lands normally belong to either joint or nuclear families. They grow varieties of mono or mixed crops and vegetables.

Table 1. Indigenous knowledge and world-views related to tribal agricultural practices

Activity	Indigenous knowledge	Socio-cultural and religious practices
Classification of agriculture	3 types (shifting cultivation, terrace cultivation, plain land cultivation)	
Types of shifting cultivation	5 types (Arengbur, Jalengbur, Jakupbur, Takup, Ragdibur)	Performing community ritual before selection of area for shifting cultivation
Soils suitable for specific crops	Red soil : little millet, finger millet, tubers Black soil : little millet, finger millet, dry paddy Sandy soil : tubers, hill paddy, jowar, red gram, finger millet, niger Rocky soil : niger, black gram, cowpea, beans, red gram, minor millet Red and black soil mixture : paddy and vegetables	**Important agriculture related festivals:** Total no. of festivals Area and land selection for shifting cultivation Soil testing Seed testing Making agricultural implements Pest control and crop health Harvest conservation (for food security) Wild leafy vegetables conservation Rain making
Soil testing	Soil testing by observation of the health (colour, size) of germinated seedlings during *Bali Parob* Texture of soil; weight; taste; colour	Soil testing ceremony by name *Bali Parob*

Activity	Indigenous knowledge	Socio-cultural and religious practices
Seed testing for germination and seed health	Observation of germination of seed, colour of the germinated leaf, root, stem and even soaked seed coat during *Chaitra Parob*	Seed testing ceremony by name *Chaitra Parob*
Intercropping patterns/ systems in mixed agriculture	Cropping of heterogeneous varieties, e.g.: 1) Maize with beans 2) Jowar with red grams 3) Little millet with jowar/maize	Crop calendar (as per astrological calculations) – (Ploughing, land tilling, hoeing, seed broadcasting, harvesting and threshing) See Annex-1
Knowledge on duration of crops (area specific)		**Agricultural knowledge through symbols:** 9
a) Short duration crops	**50-60 days:** Little millet – Araku, Koraput Italian millet – Kondhs, Kondareddis of Orissa and Andhra Pradesh Maize – Koyas of Chattisgarh and Andhra Pradesh	Land management; soil treatment; seed treatment; transplantation; harvesting; pest control; rain making
b) Long duration crops	**7-8 months:** Black jowar (*Nalla/kaki jonna*) – tribes of Andhra Pradesh–Orissa border **9-10 months:** Hill red gram (*Kaliya kandi*) – tribes of Koraput–Visakhapatnam border	
Knowledge on weed management (women)	Weeds for crop health – green manure, mulching Weeds for cattle health – fodder Weeds for human health – medicinal plants Weeds for nutrition – leafy vegetables	

Activity	Indigenous knowledge	Socio-cultural and religious practices
Seed broadcasting, transplantation and spacing techniques	• Number of fistfuls and no. of fistfuls per acre (seed rate) • Number of throws for each grip (spacing) • Song narrates the spacing technique for transplantation of different plants Millets Beans Cereals Oil seeds	
Knowledge of seed storage	Millets Pulses Cereals Tubers Oil seeds	
Knowledge on natural and botanical pest control	**Natural:** Spiders (social spider), black ants, quails, reptiles **Botanical:** About 25 species of major plants (parts used: leaf, bark, stem, tuber, fruit)	
Knowledge on harvesting techniques (women)	Sustainable harvesting techniques	
Songs	*Beddaroppa* – transplantation *Oylee geeth* – land management *Tode geeth* – weed management	
Proverbs	Soil related: *Puttamannu – gattimannu* Weather forecasting related: *Uttara choosi – yettara gampa* Seed broadcasting: *Vadlu okati – visurlu rende*	
Traditional knowledge and technology transmission practices	Dormitory education known as "Gothul" in different forms with different names (songs, dances, music, proverbs, practical demonstrations and participation)	

Relevance of tribal indigenous knowledge and world-views and their application for endogenous development

Indigenous tribal agricultural knowledge and related world-views are rapidly eroding because of modernization and acculturization. Tribal traditional institutional functionaries – the custodians of knowledge on agriculture and related world-view practices – play a big role in the agricultural development and farming practices. The healers responsible for crop health are called *Taas Guniy*, and they help the community take care of crop health by using herbal medicines and mantras and by performing rituals related to crops. The other functionaries help the community in land and soil management. Modernization and the influx of mono crops and other cash crops and new crop management practices are adversely affecting tribal traditional agricultural practices. The functions of the functionaries are also vanishing rapidly owing to modernization and socio-political reasons. The traditional knowledges are dying on the one side, and on the other, the hybridization process of tribal agriculture has begun, leading to a loss of diversity in the traditional agricultural knowledge in the tribal belts. This includes related significant world-view practices and the custodians of the knowledge – the tribal traditional institutional functionaries. Therefore, it is time to focus attention on some of the relevant indigenous knowledges and related practices and to revive them in agriculture through the endogenous development approach.

Table 2. Agricultural practices to be revived through the endogenous development approach

S. no	Activity	Relevance for endogenous development approach
1.	Area selection for shifting cultivation	The changing biodiversity and agro-ecological conditions means there is a need to integrate traditional cultural and ecological criteria to obtain sociologically acceptable, economically viable, environmentally sound and culturally ethical lines of sustainable endogenous development.
2.	Soil suitable for specific crops	This knowledge is to be revived to improve the land management practices of the mountain agricultural farmers.
3.	Soil testing	For many tribal communities (80%), especially in remote areas, this traditional soil testing is the only alternative. Because ecological conditions and soil health conditions are constantly changing, their vitalities need to be monitored before agricultural operations are started. Hence, this traditional soil testing knowledge and related rituals are to be further studied and enhanced with modern knowledge systems.

4.	Seed testing	Similar to soil testing, this knowledge on seed testing and the related festival *Chaitra Parob* are the only alternatives to 80% of farmers. This can be further studied and enhanced with modern knowledges.
5.	Knowledge on duration of crops	The changing ecological, climatic and agronomical conditions in the tribal belts means there is a need to adapt/revive the knowledge on duration of crops to ensure sustainable agricultural crop returns to farmers.
6.	Knowledge on weed management	Traditional knowledge on weed management for the successful control of weeds through knowledge application is essential in the tribal belts. About 35–40% of the tribal crop loss is due to weeds. This can be minimized by reviving this indigenous knowledge on weed management.
7.	Seed broadcasting, transplantation and spacing techniques	The changing agro-diversity and agro-ecological conditions and crop management practices means that proper broadcasting, transplantation and spacing techniques are required. This indigenous knowledge can be revived and integrated with modern knowledge for better results.
8.	Knowledge on natural and botanical pest control	The use of natural and botanical pest control methods by the tribals has been in practice for generations and they are time-tested. For revival, their standard operating procedures (SOP) can be further standardized with more experimentation and validation. The transmission of this knowledge is associated with the festival called *Ashada Jatara*. Hence, this can be revived.
9.	Indigenous knowledge and technology transmission process through songs, proverbs and dormitory education	Traditional village councils and their traditional institutional functionaries and senior farmers possess vast knowledge on agriculture in the form of songs and proverbs. These can be revived and promoted through different programmes.

IDEA's efforts to promote endogenous development in tribal agriculture

1. A detailed documentation of indigenous knowledge and world-views related to tribal agriculture has been carried out.
2. On-farm validation of the knowledge systems and related world-views and their rationalities have been conducted.
3. Soil and seed testing knowledges and related ceremonies such as *Bali parob* and *Chaitra parob* have been revived.
4. Harvest conservation programmes have been promoted by reviving first eating ceremonies – *Nuakiya*, which is food security related.

5. Indigenous weed management practices have been revived through training programmes, dormitory education and experiments.
6. Indigenous knowledge on biological and natural pest control have been revived and enhanced through participatory action research and experiments and the evaluation of SOPs in collaboration with farmers.
7. On-farm conservation of traditional seeds has been promoted
8. Dormitory training programmes have been conducted on sustainable agriculture, agro-forestry, weed management and natural and botanical pest control etc.
9. Farmers' research units have been set up to help farmers conduct on-farm participatory action research experiments, demonstrations and training programmes.
10. Forums for crop health healers, known as *Taas Guniyas,* have been promoted with tribal healers.
11. Village crop health herbal gardens known as *Gram Taas Vaso* to be managed by the *Taas Guniyas* for the community have been promoted.
12. Documentation and experiments on the use of animal products for crop health have been conducted.

Annex-1

"Tribal Agricultural Almanacs Based on Star Science"

Cosmic influence during specific days and times of constellating sun and stars on agricultural operations and crop health

S. No.	Nature of agricultural operation	*Auspicious day*	Expected results
1.	Ploughing		
2.	Land tilling		
3.	Hoeing	Sunday - *Aswani* Monday - *Sravana* Tuesday - *Magha* Wednesday - *Kruthika*, - *Anuradha* Thursday - *Punarvasu*, - *Pushyami* Friday - *Rohini* Saturday - *Swathi*	Plants grow healthy with vitality
4.	Seed broadcasting		
	a) Crop – paddy	*Uttarashada, Sravana, Dhanistha, Sathabisha and Purvabadra.*	Good crop yield
	b) Finger millet	*Uttarabadra, Revathi, Aswani*	Good foliage and yield and healthy crop
	c) Minor millet	*Swathi and Anuradha*	Good crop yield

	d) Italian millet	*Revathi and Chitha*	Good crop yield
	e) Bitter gourd (vegetable)	*Mula and Uttarabadra*	Good crop yield
	f) Mustard	*Swathi, Anuradha*	Good crop yield
	g) Green gram	*Bharani in Sraban Mas*	Good crop yield
	h) Pumpkin	*Kruthika and Magha*	Good crop yeild

Reference: Kora Bhimanna, G Kangu, Cheddda Bhimanna etc.- tribal astrologers

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Documentation and Assessment of Ethnoveterinary Practices from an Ayurvedic Viewpoint

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Abstract

Nearly 70% of the world's rural poor depend on livestock as a critical component of their livelihood. It is estimated that approximately Rs. 50 billion are lost annually in India on account of livestock diseases. Modern veterinary health delivery is facing many constraints such as high treatment costs, inaccessibility and the presence of antibiotic and hormonal residues in milk and other animal products. The Indian subcontinent has rich ethnoveterinary health traditions that are the products of decades of experiences. Owing to various economic and political factors, this tradition is facing the threat of rapid erosion. The traditional medicines that can be used for animal healthcare can cut down costs considerably. Moreover, they are readily accessible to the ordinary farmer. The key challenges are to find out the effectiveness and contemporary relevance of these practices. The modern laboratory and clinical studies for validation take time and involve huge resources. The world-view and the theoretical foundation of modern science and traditional knowledge are completely different. Therefore, it is necessary to have an assessment that involves a world-view that is nearly similar to traditional knowledge and practices. An Ayurveda/Mrugayurveda-based assessment methodology was developed in order to find safe and efficacious ethnoveterinary practices in select locations of South India. This method is a community-based rapid assessment in which ethnoveterinary folk healers, veterinary doctors, Ayurvedic doctors, botanists and field workers play key roles. A total of 116 plant species for 19 health conditions that are commonly seen in cattle were taken for assessment in different geographical locations. The basic principle of this assessment is a consensus of opinion among different medical systems about the management of health conditions. It was found that nearly 70% of the practices had supporting evidence on their prescribed uses in Ayurveda (one of the Indian systems of medicine) and modern pharmacology.

Introduction

Prevention, control and eradication of diseases among domesticated animals are major concerns as diseases in animals lead to economic losses and possible transmission of the causative agents to humans. Livestock are the foundation of an agrarian economy, contributing about 32% of the total share from agriculture to the national GDP (Swarup and Patra, 2005). The majority of the world's rural poor depend on livestock as a critical component of their livelihood (640 million poor farmers in rain-fed areas, 190 million pastoralists in arid and mountain zones and more than 100 million people in landless households). People use meat, eggs and diary products for their food, wool and leather for clothing and animal power to till their fields. Livestock also provide manure to fertilize crops (FAO livestock policy brief). The Indian livestock sector today has 185 million cattle, 98 million buffaloes, 124.5 million goats, 6 million sheep, 343 million poultry, 13.5 million pigs, 1.6 million equines and 6.3 million camels. This represents 16% of the world's cattle and 57% of the world's buffaloes (rank-I), 18%

of the world's goats (rank- II) and 6% of the world's sheep (rank-III). The contribution of livestock to the GDP is 5.38% (valued at Rs. 120,938 crores in 2003). It is estimated that approximately Rs. 50 billion are lost annually in India on account of livestock diseases. High treatment costs, inaccessibility and indiscriminate use of antibiotics and hormones, which leads to user-unfriendly effects such as high antibiotic and hormone residues in milk and other animal products, are serious limitations of modern veterinary management. Veterinary services have a crucial role in controlling highly contagious diseases and zoonotic infections, which have implications for human health as well as that of livestock.

The presence of drugs in milk, meat and eggs can cause allergies, anaphylactic shock and toxicities in consumers. It also results in the development of drug-resistant microorganisms that are difficult to treat. Bacterial resistance to antibiotics is a far more serious threat to animal and human health than the low levels of residues that may be found in animal foods. Drug-resistant pathogens like *Salmonella* that occur in animal foods may be transferred to and be pathogenic in man and can cause illness and death (Khoda, 2005). All the antimicrobial drugs administered to cows enter the milk to some degree. A drug administered to a milk-producing animal has a withdrawal period, during which the drug residue should fall below a predetermined level. The residue can be of the drug itself or its metabolites. The testing for residue is of significance for ethical, public health, dairy technological and environmental reasons (Merai and Boghra, 2004).

Ethnoveterinary or folk medicine pertaining to animal healthcare is as old as the domestication of various livestock species. There are rich and efficient ethnoveterinary traditions in the villages of India that form an integral part of family life and play an important social, religious and economic role. They comprise belief, knowledge, practices and skills pertaining to healthcare and management of livestock. There are local healers (*Pashu vaidyas*) who are knowledgeable and experienced in traditional veterinary healthcare. Folk health practices largely remain undocumented and are passed on from one generation to the other by word of mouth. They use the locally available medicinal plants for treatment of animals. Local healers are very popular in their communities, and farmers generally consult them. Ethnoveterinary systems are ecosystem and ethnic community specific, and therefore, the characteristics, sophistication, and intensity of these systems differ greatly among individuals, societies and regions. These local veterinary health practices are accessible, affordable and culturally acceptable.

Ancient Egyptians used various methods including the application of herbs for the treatment of animal diseases, and it is believed that during that period physicians had knowledge of more than 250 medicinal plants and 120 mineral salts (Swarup and Patra 2005). Veterinary science in India has a documented history of around 5000 years. Veterinary and animal husbandry practices are mentioned in the *Rigveda* and *Atharvaveda*. The codified knowledge exists in the form of texts and manuscripts on various aspects of veterinary care for livestock such as health management of cattle, horse, birds and elephants. Sage Shalihotra's (1800 BC) *asvasastra* is considered the first work on veterinary science. *Hastyayurveda* (1000 BC) by sage Palakapya is the most ancient text on elephants. *Pashu vaidya mattuvagadam,* a Tamil book based on ancient Tamil palm leaf manuscripts, discusses over 250 diseases in cattle and their management. *Matsyapurana, Garudapurana, Agnipurana, Brahmanandapurana* and

Lingapuranah have veterinary information. *Arthasastra* by Kautilya describes cattle, buffalo, sheep, goat, horse, elephant and other animal rearing. It also gives a detailed account of welfare practices for livestock and regulation for the protection of wildlife.

The use of antibiotics and other chemical products has in fact been banned for animal healthcare in many countries, and the world is looking for safer herbal alternatives. Ethnoveterinary science of India thus has great potential to address the current challenges faced by veterinary medicine as it has decentralized local resource–based applications that are safe, efficacious and create no adverse effects in animals. However, it is facing the threat of rapid erosion. The urgent revival of these traditional veterinary practices is a high priority in the light of the constraints of modern medicine and the benefits of these practices in terms of their accessibility, affordability and acceptability. The Indian Council of Agricultural Research in 2000 collected and recorded 595 veterinary traditions from different sources (Swarup and Patra, 2005). About 48 of them were recommended for scientific validation, and some have shown therapeutic and ameliorative potential. In another work on "Identification and evaluation of medicinal plants for control of parasitic diseases in livestock", 158 plants have been catalogued and 50 have been evaluated for antiparasitic activity (Anonymous, 2003).

The commercialization of herbal medicines for animals in India is much more advanced than in other countries, with the exception of China. The total market for animal healthcare products in India is estimated at about Rs. 1600 crores (about 400 million US$). Out of this, about Rs. 200 crores (about 50 million US$) is the share of herbal products. An estimate shows that the gap in demand and supply of veterinary healthcare products is Rs. 7600 to 10,500 million (Swarup and Patra, 2005). Modern veterinary care reaches only 20% of livestock owners. Hence, there is enormous scope to develop standardized herbal products for veterinary healthcare. The key issues expected to be resolved are

1. Reduction in the cost of healthcare for the milch animals of dairy farmers;
2. Reduction in antibiotic and hormone residues in milk and other animal products by using safe, effective and standardized products based on time-tested local traditions;
3. Provision of timely veterinary service to farmers in response to the primary healthcare needs of their livestock and
4. Contribution to the economy of local producers.

A participatory rapid assessment programme was designed to revitalize ethnoveterinary traditions and to find safe and efficacious ethnoveterinary health practices in select locations of South India. The locations selected for the study were Dakshina Kannada Milk Union, Mangalore; BAIF, Tiptur; Society for Rural Development Dharmapuri; Convenant Centre for Development, Madurai; SEVA, Madurai and Wayanad Social Service Society.

Objectives of the study

- To prioritize and document local ethnoveterinary practices.
- To assess these practices and knowledge for their efficacy and safety on the basis of evidence from the literature of Indian systems of medicine (ISM) such as Ayurveda/Mrugayurveda and from modern plant pharmacology.

- To promote positively assessed practices through various extension programme such as training, establishment of home herbal gardens, publications and product development through local enterprises.
- To revitalize ethnoveterinary health traditions.

Why rapid assessment of ethnoveterinary medicine using Indian systems of medicine?

Traditional systems of medicine in India include codified systems such as Ayurveda, Siddha, Unani and Tibetan and non-codified oral or folk traditions. The codified systems are based on the theory of physiological functioning, disease aetiology and clinical practices. They have formal traditions of training and possess an extensive collection of written documents, the *materia medica*, that discuss specialized subjects related to medicine and surgery, clinical procedure and medical ethics. The non-codified folk traditions are practiced by local healers and have been transferred from generation to generation orally or by demonstration. These Indian systems derive from the world-view that living beings share all their elements with the world outside and *vice versa*, thus showing their oneness. The philosophical foundations of Ayurveda are derived from *sad-darshanas*. Its logical system is *nyaya vaisesika*. The means of knowledge is *apta* (verbal testimony), *pratyaksa* (direct perception), *anumana* (inference) and *upamana* (analogy). For example, in indigenous pharmacology (*Dravya guna sastra*), the entire plant and/or its parts (leaves, stem, roots, bark, flowers, fruits and seeds) are studied as a whole in terms of the following types of parameters: *Rasa* or taste, *Virya* or potency, *Vipaka* or post- digestive state and *Prabhava* or unique biological activity. Each of these is suggestive in terms of the biological and therapeutic activity. Even though the logic of folk knowledge lacks the theoretical rigour of Ayurveda or modern medicine, there is an inherent relationship between classical textual knowledge and folk knowledge. The world-view and the theoretical foundation of modern science and traditional knowledge are completely different. Codified Indian medical traditions (Ayurveda/Mrugayurveda) have a world-view that is similar to that of oral folk traditions, and therefore, they are better tools for the assessment of folk health traditions (Unnikrishnan and Shankar, 2005). It is necessary to find out the effectiveness and contemporary relevance of ethnoveterinary knowledge and practices. This involves a critical and comprehensive assessment of these practices using ISM.

Rapid assessment of ethnoveterinary health traditions

The modern laboratory and clinical studies for the validation of traditional knowledge and practices take time and involve huge resources. Rapid assessment of ethnoveterinary health traditions is a participatory method developed in order to document and validate ethnoveterinary knowledge in a rapid and cost efficient way. In this process, traditional health practices are assessed through a method of dialogue and consensus, wherein local healers, veterinary doctors, researchers, community members and other ethnoveterinary experts take part. The process involves

comprehensive documentation of health practices, desk research for finding out and compiling scientific data on these practices and assessment workshops for prioritizing and selecting practices for promotion. The assessment workshops form a pluralistic-medicine platform for a cross-cultural dialogue between traditional and contemporary medical sciences. The participants in this programme are folk healers, veterinary doctors, Ayurvedic doctors, botanists, documenters and members of the community.

Methodology

Documentation

Folk healers sign Prior Informed Consents (PICs) before their knowledge on traditional health practices is documented. Various health conditions of the animals in the community are listed and prioritized by free listing and by matrix ranking based on criteria (commonality of the condition, cost of treatment, fatal and seasonal nature of the condition) laid down by the community. The criteria may vary in different locations. Documentation is done in groups to facilitate the documentation process. Each group ideally consists of five to seven folk healers, a veterinary doctor, a doctor of an indigenous system of medicine, a botanist and a documenter. Documentation includes general details of the folk healer (*vaidya*), details of the health condition as understood by the folk healer (*vaidya*), remedial measures for the health condition, correlation of the health condition both in modern veterinary science and an ISM and the resources used for the treatment. The plant resource is identified by the botanist.

The documentation questionnaire consists of the PIC form, a datasheet to document the health condition and its remedy, a datasheet for the veterinary doctor to correlate the folk health condition to modern veterinary science, a datasheet for the plant specimen identified by the botanist, a datasheet for the practitioner of the ISM to correlate the folk health condition to the ISM (Ayurveda/Mrugayurveda etc.).

Desk research

In this way, the documented health conditions and practices are rigorously analyzed and correlated with literature on Ayurveda/Mrugayurveda and modern veterinary science and plant pharmacological studies.

Assessment workshop

An assessment workshop is conducted in a local community with community members, folk healers, veterinarians and Ayurvedic doctors along with other subject experts. The various experts who participate in the workshop comment on a particular health condition and practice on the basis of the data available from their own respective knowledge systems and the desk research. Positive evidence for a particular practice either from the community's own experience or from any one of the systems of medicine forms the criteria for promotion. If there is any additional aspect to be added to a particular practice on the basis of any experience or literature reference, it is shared and added. If there is negative evidence about a practice from any of the systems of medicine, the practice is kept aside for further detailed research. Following the assessment, clinical evidence is collected on a particular practice on the basis of pilot clinical studies. Selected best remedies are made into suitable product through local enterprises.

Limitations of the study

The first level of assessment is based on the consensus among the healers and other practitioners, supported with literature and available pharmacological studies. These assessments are not based on clinical studies in the field. Therefore, many of the practices do not carry the tag of any clinically proven records or observational data from the field.

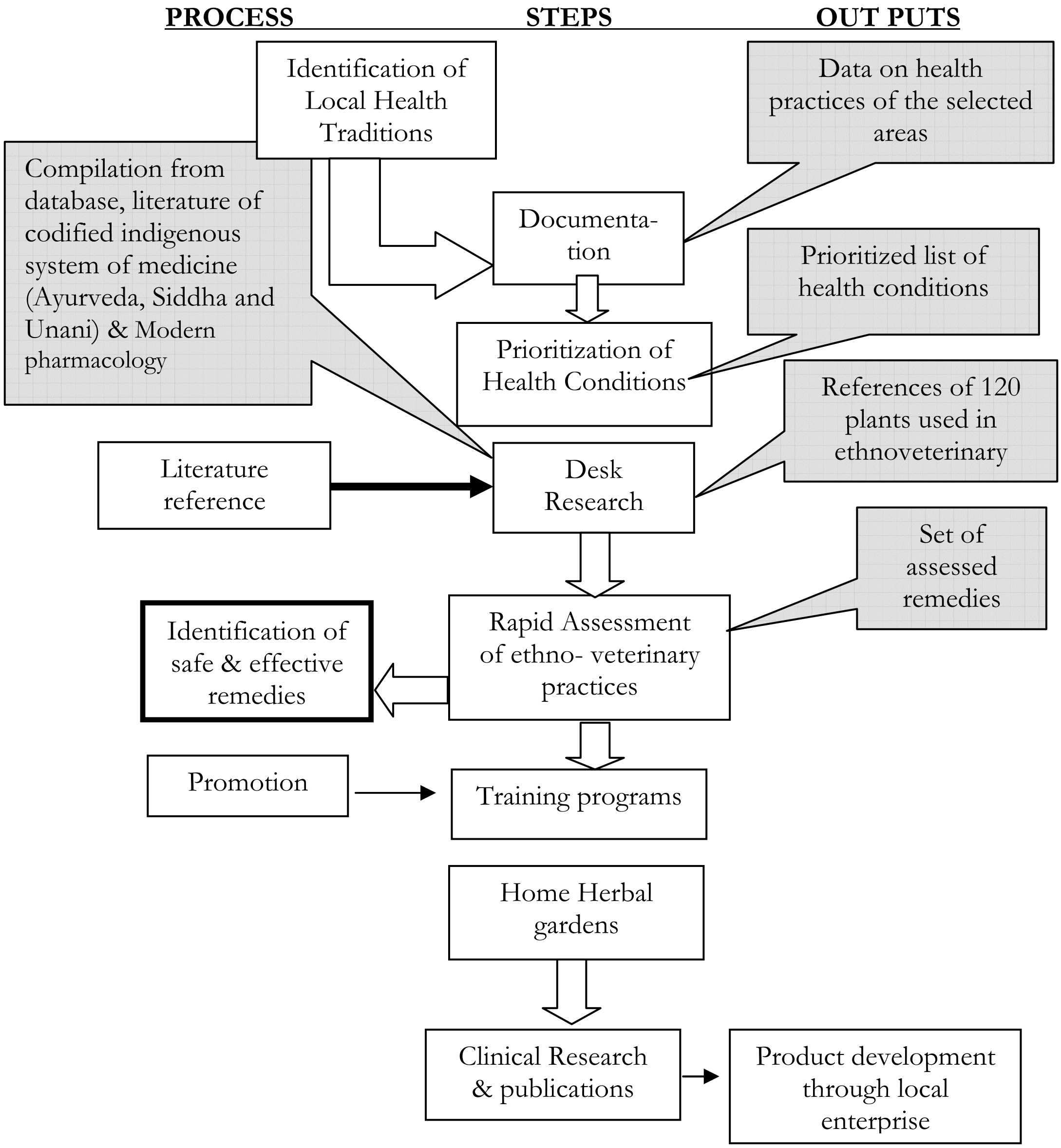


Figure 1. Process of rapid assessment of local health traditions

Case study

Table 1. Prioritized list of animal health conditions

S. No	Local name (Kannada language)	Modern veterinary science	Ayurveda (ISM)
1	*Kechala baavu*	Mastitis	*Sthana vidrahi*
2	*Ajeerna*	Indigestion	*Ajeerna (vistabdha)*
3	*Garbha dharisalu tondare*	Repeat breeder/habitual abortion	*Apatyaya / Garbha srava*
4	*Jvara*	Pyrexia	*Jvara*
5	*Charma roga*	Dermatitis	*Kusta*
6	*Bhedi*	Enteritis/diarrhoea	*Atisara*
7	*Khemmu*	Bronchitis	*Kasa*
8	*Janthu hula*	Helminthiasis	*Krimi*
9	*Kattu roga*	Constipation/impaction of the rumen and retinaculum	*Vibandham/Alasaka*
10	*Garbha kosha horabaruvudhu*	Prolapse of uterus	*Yoni bhramsha*
11	*Kasa beelade iruvudu*	Retention of placenta	*Apathitha apara*
12	*Havu Kaditha*	Snake bite	*Sarpa damsha*
13	*Chappe roga*	Black quarter	*Pittajasopha/Visarpa*
14	*Kaalu baayi Jvara*	Foot and mouth disease	*Sannipata jvara/Agni visarpa*
15	*Kadime hal/Halu manda*	Hypogalactia	*Stanya kshaya*
16	*Moole jaruvudu/moole muritha*	Fracture/dislocation	*Asthi bhagna/sandhi mukta*
17	*Shale/Vayu/Kundu*	Ephemeral fever	*Trithiyaka Jvara*
18	*Hotte Ubbara*	Bloat	*Adhmana, Gulma, Vistabdha ajeerna*
19	*Minchu roga*	Basari plant poisoning	*Sthavara visha*

The following are the criteria for prioritization of animal health conditions:

1. Commonality
2. Serious/fatal
3. Affects milk yield
4. High treatment cost
5. Managed effectively by ethnoveterinary medicine

Table 2. Assessment of local animal health conditions

S. No	Health condition	No. of remedies	Evidence from Ayurveda	Evidence from western biomedicine
1	Mastitis	10	9	9
2	Indigestion	6	6	6
3	Repeat breeder/habitual abortion	7	6	6
4	Pyrexia	6	4	4
5	Dermatitis	6	5	5
6	Enteritis/diarrhoea	5	3	3
7	Bronchitis	4	4	4
8	Helminthiasis	5	5	5
9	Constipation/impaction of the rumen and retinaculum	1	1	1
10	Prolapse of uterus	3	0	0
11	Retention of placenta	3	1	1
12	Snake bite	6	6	6
13	Black quarter	2	2	2
14	Foot and mouth disease	5	3	3
15	Hypogalactia	1	1	1
16	Fracture/dislocation	4	2	2
17	Ephemeral fever	3	2	2
18	Plant poisoning	2	2	2
19	Bloat	7	7	7
Total		**81**	**69**	**69**

An illustration – mastitis

Local name of mastitis: *Kechala baavu*

Table 3. Folk understanding of *Kechala baavu*

Disease entity	Aetiology	Clinical features
Kechala baavu	• Incomplete milking from the udder that is, presence of residual milk in the udder • Trauma or insect bite on the udder • Excessive feeding on tender plants of *avare chiguru* (*Dolichos sp.*) and *kaaki jola* (maize stalk) • Unhygienic condition of the cattle shed and feeding methods • Ingestion of worms • Evil eye on the high milk-yielding udder of the cow	• Local changes: reddish swollen udder with extreme pain and tenderness at times, hard and warm to touch • Milk changes: milk is often yellow or curdled, has blood tinge at times and also a few suspended particles are seen in milk of the affected udder. **Other opinions:** 1st stage: saltish taste of milk 2nd stage: curdled milk 3rd stage: hard udder, less milk yield • Others: the outer ear (pinna) is also thickened; fever and animal is off its feed and looks dull

Ayurvedic understanding of mastitis

Observing the cause and symptoms as per folk medicine, the above health condition *Kechala baavu* as per Ayurveda can be stated basically as a *pitta* [*Pitta* is one of the *doshas* (morbid elements present in the body), which triggers the disease] *dosha* predominant condition, which includes diseases such as *sthana vidradhi, sthana kilaka, pitta-vidradhi* (or) *rakta vidradhi* (various types of abscess).

Modern understanding of the health condition

Mainly, an inflamed udder and changes in the colour of milk and the appearance of flakes in the milk. Three phases in the development of mastitis have been described.

1. The invasive phase: the bacteria are able to enter the teat orifice and be present in the teat canal and cristern.
2. The infection phase: the organisms are able to overcome the immune system and so multiply.
3. The inflammatory phase: the organism invades the udder.

Table 4. Ayurvedic and modern understanding of *Kechala baavu* (mastitis)

<table>
<tr><th>Ayurvedic understanding</th><th>Modern veterinary understanding</th></tr>
<tr><td>Sthana vidradhi[§]: Swelling, heaviness and resembles an abscess in appearance over the breast</td><td rowspan="2">Mainly inflamed udder, changes in the colour of milk and appearance of flakes in milk.
Three phases in the development of mastitis have been described.
1. The invasive phase: the bacteria are able to enter the teat orifice and be present in the teat canal and cristern.
2. The infection phase: the organisms are able to overcome the immune system and so multiply.
3. The inflammatory phase: the organism invades the udder.</td></tr>
<tr><td>Sthana kilaka[**]: Swelling, pain, inflamed and unbearable pain on touching of the female breast. Similarly identical features are seen in rakta vidradhi[††] and are only seen in females</td></tr>
</table>

Remedies for *Kechala baavu* (mastitis) as reported by the folk healer

Remedy: 1

External application of *Wattakaka volubilis* (leaves and stem) paste over the affected udder.

Comments based on Ayurvedic understanding

Any inflammation is basically due to the involvement of *pitta dosha*. *Kechala baavu* or mastitis is an inflammatory condition, and the predominance of *pitta dosha* is inferred by its inflammatory and suppurative nature. The plant species *Wattakaka volubilis* pacifies *pitta dosha*. Hence, this remedy should be effective for mastitis. (*Na paakah Pittath ruthe*[‡‡]*,* which means there is no suppuration in the absence of *pitta dosha*.)

Remedy: 2

External application of *Wattakaka volubilis* (stem) and *Commelina benghalensis* (leaves) paste over the affected udder.

Comments based on Ayurvedic understanding

This formulation contains *Commelina benghalensis* besides *Wattakaka volubilis* the usage of which was substantiated in the earlier formula.

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§ Astanga Sangraha, Nidanasthana, Chapter 11 / verses 21–22.
** Kashyapa Samhita, Sutrasthanam, Chapter 19.
†† Astanga Sangraha, Nidanasthana, Chapter 11.
‡‡ Susrutha Samhita, Sutrasthanam, Chapter 17.

Modern pharmacological data

As per modern pharmacological studies, *Commelina benghalensis* has antibacterial action against *Pseudomonas*, *Staphylococcus*, *Escherichia coli* and *Bacillus subtilis*§§. Hence, this formulation has some supporting evidence in its usage against *Kechala baavu* (mastitis).

Remedy: 3

A handful of *Andrographis serpyllifolia* (leaves and roots), 15 flakes of *Allium sativum* bulb and *Piper nigrum* (9 nos.) ground to a paste and orally administered thrice a day for a period of 9–21 days.

Comments based on Ayurvedic understanding

There are no Ayurvedic plant references for *Andrographis serpyllifolia*

Modern pharmacological data

There is no information on the usage of this plant species to treat mastitis or allied problems as per modern pharmacology.

Assessment of practice for *Kechala baavu* (mastitis)

Out of the above-mentioned three formulations, two have supporting literary evidence from an ISM (Ayurveda) and modern pharmacology. Only one formulation has no supporting evidence either from an ISM or modern pharmacology. But that does not mean that the practice is not effective. The community's opinion has to be sought about the health practice. If the health practice is found to be effective according to the community, it is recommended for wider promotion. In case of ambiguous evidence on efficacy or safety, it is put aside for further detailed examination.

Table 5. Assessment results for *Kechala baavu* (mastitis)

S. No	Health practice	ISM doctor	Veterinary doctor	Community	Promotion
1	Remedy 1	Yes	Do not know	Yes	Yes
2	Remedy 2	Yes	Yes	Yes	Yes
3	Remedy 3	No	No	Yes	After careful study

Conclusion

Ethnoveterinary practices have immense contemporary relevance. A rapid participatory assessment model for finding out the best practices was developed and tested in four geographical locations in Southern India. Nearly 120 plant resources for nearly 20 health conditions were studied during this programme. Seventy per cent of

§§Napralert Database, University of Illinois, Chicago.

the remedies were found to have positive evidence from various systems of medicine and practical experience. Fifty per cent of the ingredients of the remedies can be easily grown in home herbal gardens and are locally available. Twelve remedies have gone through pilot clinical studies and have been made into products, which are now being made through local enterprises. The National Diary Development Board (NDDB), Government of India, has now successfully implemented this programme. It is learned in the process that this model if promoted widely can be of immense use to rural communities. We believe revitalization of ethnoveterinary theory and practice holds the key to better animal health and hence to the prosperity of animal farmers in rural India.

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Punyakoti Test – An Ancient Egyptian Test (2200 BC) Extended to Diagnose Pregnancy in Cattle

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Abstract

On the basis of ancient Egyptian knowledge obtained from medical papyri, which dates back 4000 years, a simple non-invasive test has been developed to diagnose pregnancy in cattle. In ancient Egypt, doctors were apparently diagnosing pregnancy in women by treating wheat and barley seeds with the urine of the woman suspected of being pregnant. She was diagnosed as pregnant if the seeds germinated and as non-pregnant if they did not. This test was extended and standardized to make it suitable for the diagnosis of pregnancy in cows and buffaloes. The test is simple, non-invasive and can be easily applied in rural veterinary hospitals and artificial insemination centres, which is important as 70% of the livestock in the villages of rural India do not have access to modern pregnancy diagnostic facilities.

The Punyakoti seed germination test *involves treating wheat seeds with 15 ml of diluted urine from the cow whose pregnancy is to be diagnosed. Simultaneously, a set of four petri dishes containing wheat seeds treated with 15 ml of water serves as the control. After five days, the cow can be diagnosed as pregnant if the wheat seeds have not germinated and have turned brown to blackish in colour and as non-pregnant if the seeds have germinated, exhibit good seedling growth (a mean shoot growth 4.00 ± 0.47 cm) and appear similar to those in the controls. The mean germination and shoot length of wheat seeds treated with urine from a pregnant cow were found to be significantly different from that of seeds treated with urine from a non-pregnant cow or with plain water. The results that were obtained for cattle were just opposite to those obtained for women as deciphered in the papyri of ancient Egypt (2200 BC).*

The test has been applied successfully on more than 250 cows, and attempts are being made to identify the chemical/factor in urine responsible for the differential germination of the wheat seeds. Apart from the normal urinary constituents such as urea and uric acid, a plant hormone known as Abscisic acid (ABA) has been identified in the urine of cattle. Its main effect on seeds is to maintain their dormancy. A high concentration of ABA is found in the urine of pregnant cows (170.62 nanomoles/ml of urine) as compared with that in the urine of non-pregnant cows (74.46 nanomoles/ml). The presence of ABA could be one of the factors causing the observed decreased germination and shoot growth of wheat seeds when they are treated with the urine of pregnant cows. On the basis of this, an attempt will be made to develop a simple bioassay kit, which can be readily used in the rural areas to diagnose pregnancy in cows and buffaloes.

Thus, the modified seed germination bioassay (Punyakoti test) is simple, non-invasive, from the animal welfare point of view, and does not require any chemicals or sophisticated instruments. The test has been extended to buffaloes, sheep and goats using locally available seeds such as paddy and green gram so as to suit the needs of the farmers and dairy owners of rural India.

India being a land of agriculture, farmers depend on animal husbandry for their livelihood. The total cattle population is 280 million, 70% of which are in rural areas and these cattle do not have access to modern diagnostic techniques. Pregnancy

diagnosis is an important requirement for successful dairying and to increase the wealth of farmers. At present, there are no simple laboratory tests available to diagnose pregnancy in the cattle and buffaloes of rural India. The methods available to diagnose pregnancy such as ultrasonography, radio immunoassay, rosette inhibition test etc. have mostly been developed in western countries and cannot be implemented in the rural areas of developing countries as they are sophisticated, costly and laborious. The only method widely used at the field level is the rectal palpation method for pregnancy detection. But, this method has its own disadvantages as the pregnant cows have to be brought to the nearest veterinary hospital or artificial insemination centre, which are generally located at least 4–10 km away, and this puts stress on pregnant cows. Secondly, about 10–20% of rectal examinations result in rectal bleeding or embryonic mortality.

A simple pregnancy diagnostic technique was developed on the basis of an ancient practice deciphered from medical papyri, dating back 4000 years, recovered from the tombs of Egypt. According to the papyri, in ancient Egypt, doctors for humans were diagnosing pregnancy in women on the basis of a seed germination method. The woman suspected of being pregnant was asked to urinate on cotton bags containing wheat and barley seeds. The woman was diagnosed as pregnant if the seeds germinated and as non-pregnant if they did not. On the basis of this ancient clue, a simple technique was developed that involves the germination of wheat seeds in the diluted urine of the cow whose pregnancy is to be diagnosed. Inhibited germination suggests pregnancy and uninhibited growth suggests non-pregnancy in cows. With this as the basis, continuous efforts have been made at the Veterinary College, KVAFSU, Hebbal, Bangalore to develop a simple and non-invasive field-oriented pregnancy detection test. The technique has been christened the ***Punyakoti* test** and can easily be carried out by field veterinarians and dairy owners and farmers in rural areas on their farms.

The *Punyakoti* seed germination test involves treating wheat seeds (15 seeds placed in a petri dish containing filter paper) with 15ml of diluted urine (1 ml of urine with 14 ml of water) from the cow whose pregnancy is to be diagnosed. Simultaneously, a set of four petri dishes containing wheat seeds treated with 15 ml of water serves as the control. After five days, the cow can be diagnosed as pregnant if the wheat seeds have not germinated and have turned brown to blackish in colour (mean germination is $46.48 \pm 4.24\%$, with a mean shoot growth of 0.93 ± 0.83cm) and as non-pregnant if the seeds have germinated (mean germination is $75.40 \pm 6.99\%$), exhibit good seedling growth (mean shoot growth 4.00 ± 0.47cm) and appear similar to those treated with water (mean germination is 87.70 ± 5.13 %, with a mean shoot growth 6.43 ± 0.34 cm). The mean germination and shoot length of wheat seeds treated with urine from a pregnant cow were found significantly different from that of seeds treated with plain water or urine from a non-pregnant cow. The results that were obtained for the cattle were just opposite to those obtained for women as deciphered in the papyri of ancient Egypt (2200 BC).

The *Punyakoti* diagnosing technique has so far been tested on more than 250 cows and buffaloes and has also been demonstrated for the farmers who visited the Krishimela at the University of Agricultural Sciences, Bangalore, and the knowledge is slowly spreading among farmers. On several occasions, farmers have modified the test to suit their needs. For example, in the rural areas of North Canara district of

Karnataka, wheat seeds are not always available and farmers have used paddy seeds instead of wheat seeds and have obtained similar results. Some enterprising farmers are even reporting their results on these successful modifications in the print media.

At present, attempts are being made to identify the chemical/factor in the urine of pregnant and non-pregnant cattle responsible for the differential germination response of seeds treated with it. Apart from normal urinary constituents such as urea and uric acid, a plant hormone known as Abscisic acid (ABA) has been identified in the urine of cattle. Its main effect on seeds is to maintain their dormancy. A high concentration of ABA is found in the urine of pregnant cows (170.62 nanomoles/ml of urine) as compared with the urine of non-pregnant cows (74.46 nanomoles/ml of urine). Abscisic acid could be one of the factors causing the observed decreased germination and shoot growths of wheat seeds when they are treated with the urine of pregnant cows. An attempt will be made to develop a simple bioassay kit based on this hormone, which can be readily used in the rural areas to diagnose pregnancy in cows and buffaloes.

Thus, the modified seed germination bioassay (*Punyakoti* test) is simple, non-invasive, from the animal welfare point of view, and does not require any chemicals or sophisticated instruments. The test has been extended to buffaloes, sheep and goats using other locally available monocot and dicot seeds such as paddy, Jowar, Navane and green gram so as to suit the needs of the farmers and dairy owners of rural India.

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Promotion of Ethnoveterinary Medicine in Dakshina Kannada District, Karnataka

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Abstract

The Indian economy has been demonstrating an impressive overall growth in recent years. However, the agricultural sector has been growing at the negligible rate of less than 2% per annum. The GDP share of the agricultural sector that was around 35% in early eighties has now come down to 23% (Belavadi, 2005). This dismal growth is especially a matter of great concern given the fact that 58% of the population depends on agriculture for its livelihood. It is however a matter of consolation that the GDP share of the livestock sub-sector within the agricultural sector has grown marginally from 4.8% in the early eighties to 5.5% in 2004.

The livestock subsector has a significant role in the rural economy. Dairying especially is of vital importance to the livelihood security of rural poor. Around 80% of bovine owners in India belong to the below poverty level (BPL) population. They consist of landless, marginal and small farmers. For the dairy farmer, cattle feed accounts for more than 70% of the total cost of milk production. Animal disease continues to be a major drain on a farmer's income. Public veterinary healthcare reaches only 20% of livestock owners in the country, leaving a big gap between the demand and supply of healthcare services (Hariramamurthi and Udupa, 2005). High treatment costs, inaccessibility and side effects such as high antibiotic and hormonal residues in the milk are the serious issues of present day veterinary care. Any effort made to improve incomes from livestock has a direct bearing on increasing equitable distribution of rural incomes

In this context, promotion of ethnoveterinary medicine was attempted from 2001-5 in Dakshina Kannada, Karnataka by the Foundation for Revitalisation of Local Health Traditions. This was considered by the National Dairy Development Board to be one of the measures to reduce the cost of milk production to dairy members on the one hand and to improve the quality of milk for consumers on the other. The Dakshina Kannada District Coop. Milk Producers Union extended its full support and co-operation to FRLHT for the implementation of the programme.

The methods of intervention included documentation, rapid assessment of ethno-veterinary cost-effective measures, such as the home herbal gardens maintained by dairy members, and promotion of herbal veterinary products for improving livestock health, productivity as well as returns from livestock from the community owned enterprise, Parampara Herbal Producers Company Limited. Women self-help group (SHG) members and leaders were trained in growing and using ecosystem specific medicinal plants to meet the primary healthcare needs of their family members and milch animals, leading to savings in primary healthcare related expenses. In the last three years, the use of allopathic drugs to meet a number of veterinary health conditions has drastically reduced (Khoda, 2005). A few of the

home remedies that proved to be effective were developed into cost-effective and licensed herbal products, produced and marketed to dairy members by the Parampara Herbal Producer Company to meet veterinary healthcare needs for problems such as mastitis, bloat, maggot wounds etc.

Background

The Indian economy has been demonstrating an impressive overall growth in recent years. However, the agricultural sector has been growing at the negligible rate of less than 2% per annum. The GDP share of the agricultural sector that was around 35% in the early eighties has now come down to 23% (Belavadi, 2005). This dismal growth is especially a matter of great concern given the fact that 58% of the population depends on agriculture for its livelihood. It is however a matter of consolation that the GDP share of the livestock sub-sector within the agricultural sector has grown marginally from 4.8% in the early eighties to 5.5% in 2004.

The livestock subsector has a significant role in the rural economy. Dairying especially is of vital importance to the livelihood security of rural poor. India's total milch bovine population is reported to be one of the largest in the world at 115 million (Anonymous, 2003). Milk production during 2002–03 was reported to be 86 million tones (Anonymous, 2004). The value of the output from the livestock sector is reported to be Rs. 1561 billion at current prices and constitutes 5% our national GDP (Anonymous, 2002). Yet, around 80% of the livestock owners of the country happen to belong to the below poverty level (BPL) population. They consist of landless, marginal and small farmers. For the dairy farmer, cattle feed accounts for more than 70% of the total cost of milk production. Animal disease continues to be a major drain on a farmer's income. In India, public veterinary healthcare reaches only 20% of livestock owners, leaving a big gap between the demand and supply of healthcare services (Hariramamurthi and Udupa, 2005). High treatment costs, inaccessibility and side effects such as high antibiotic and hormonal residues in milk are the serious issues of present day veterinary care. Any effort made to improve incomes by saving on livestock health expenses has a direct bearing on increasing equitable distribution of rural incomes. In this context, documentation, assessment and promotion of ethnoveterinary medicine does offer the possibility of a solution in reducing the increasing costs of meeting livestock healthcare needs.

Ethnoveterinary medicine is generally referred to as folk knowledge, beliefs, practices, skills and methods pertaining to the healthcare of animals. These cover the areas of breeding, maintenance and care of livestock. In India, we have had the benefit of the presence of thousands of ethnoveterinary practitioners and of codified traditional health systems such as Ayurveda, Siddha, Unani and Swa-rig-pa (Tibetan) for more than 3000 to 4000 years. Yet, we continue to ignore their relevance while learning veterinary medicine in our veterinary colleges, even though it is nearly six decades after our independence.

Millions of households in India have been using indigenous health knowledge and local health traditions for ensuring human, veterinary and plant health. In India, both the folk and codified systems of medicine use around 8000 species of medicinal plants (Shankar and Geeta, 1998). Ethnoveterinary healers are carriers of local health traditions. They are the grass-root providers of veterinary healthcare services in the

rural parts of the country, especially in the most remote, inaccessible areas. More often, animal owners and keepers are themselves ethnoveterinary healers. These healers are skilled and specialized in the treatment of simple to complex conditions such as bloat, maggot wounds, repeat breeding, retention of placenta, mastitis, poisonous bites, eye diseases and fractures. They are well versed in the use of locally available medicinal plants and other resources from the local raw drug stores.

Mostly, the healers are above 45 to 60 years old. Some of the healers also treat human beings. Most of the medicinal plants commonly used for the treatment of a number of conditions suffered by human beings are also used for similar conditions affecting animals. For example, Asparagus racemosus is used to increase milk secretion and Punica granatum is used in the treatment of diarrhoea in both human beings and animals. The dosage of medicine varies according to the type and weight of the animal. The names of plants used by healers differ from one area to another, even within the same vernacular region. They are named according to their use, taste, smell, shape or form etc. Even the names of diseases are referred to differently across areas within the same vernacular region.

The remedies from medicinal plants are often given in crude forms such as in the form of coarse powders and pastes mixed along with cattle feed. Sometimes, they are mixed with a specific number of additives such as garlic, pepper or betel leaves before they are given.

Ethnoveterinary medical traditions are especially carried forward by specific ethnic communities across the country such as the *Kurubas* (Karnataka), the *Konars* (Tamil Nadu) and the *Yadavas* (Uttar Pradesh) that are traditionally known as cattle rearing and livestock keeping communities. Most of the ethnoveterinary knowledge is transmitted orally from one generation to the next through a family lineage or *guru-shishya parampara* cutting across families and ethnic communities.

A limited number of texts of classical literature of Indian systems of medicine, namely, Ayurveda, Siddha, Unani and Swa-rig-pa, dealing specially with veterinary care are reportedly available as reference materials in the country. The discipline of Ayurveda that pertains to veterinary care is referred to as *Mrig-ayurveda*. Some of these texts are specific to a particular species of animal, such as horses and elephants. In Siddha, several books, namely, *Mattu vagadam* and palm leaf manuscripts, are known to be available exclusively for veterinary care.

At the same time, medicinal plants are increasingly becoming economically important because of the growing demand for herbal products in domestic and global markets, and they are coming under increased threat because of unsustainable levels of harvesting. Over 95% of the medicinal plants used for trade and industry are from the wild, with more than 70% being harvested in an unsustainable manner. Habitat loss and overexploitation of wild populations are the major concerns related to the conservation of medicinal plants. On the basis of the global rates of species extinction, it is anticipated that around 800 to 1000 medicinally important species will face various degrees of threat across different bio-geographic regions. The International Union for the Conservation of Nature (IUCN) has identified and categorized about 200 species of medicinal plants as being rare, endangered or threatened (RET) in the wild (Uma Shankar, Ganeshaiah and Nageswara Rao, 1998).

Ethnoveterinary medical traditions, like other local health traditions and related customs, are prevalent in millions of households. But, they are unfortunately eroding

for economic, cultural and political reasons and not on account of medicinal inefficiency. The erosion of local health traditions is a very serious matter. It has civilizational consequences (Shankar and Geeta, 1998). The government both at the centre and state levels as well as in the union territories has yet to allocate any resources to promote research, development, education, training and use of traditional Indian systems of medicine in veterinary care, including ethnoveterinary care medicine.

Similarly, there is not a veterinary college or university in India that has initiated any course content for promoting the use of ethnoveterinary medicine as a part of their regular course curriculum in their undergraduate, postgraduate or doctoral courses. However, recently, there has been a continuous increase in the interest amongst veterinary scientists and research institutions seeking to undertake more research in the area of ethnoveterinary medicine, with limited funding support from the government and non-governmental institutions. Despite the threat of erosion, the value and role of ethnoveterinary medical traditions are not likely to diminish in the future because they are culturally viable and are expected to remain affordable, while the modern veterinary healthcare service is both limited and increasingly becoming more expensive. With a growing interest in the west for viable biomedicines for veterinary applications, it is likely that more research in ethnoveterinary research is waiting to happen soon in India too.

A number of NGOs in India have focused their efforts on the promotion of ethnoveterinary medicinal traditions through community-based approaches and organizations, such as SEVA (Tamil Nadu), ANTHRA (Andhra Pradesh and Maharashtra), BAIF (Karnataka and Maharashtra) and FRLHT (Bangalore). The Foundation for Revitalisation of Local Health Traditions (FRLHT), Bangalore initiated in 1993 a pioneering and concerted programme to revitalize local health traditions and conserve medicinal plants in a few Indian states. It is coordinating implementation of programmes in collaboration with community-based organizations (CBOs), NGOs and State Forest Departments in Andhra Pradesh, Chattisgarh, Orissa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu and West Bengal. In the above states, FRLHT is promoting programmes for the documentation, assessment and promotion of local health traditions as well as for the conservation and sustainable use of medicinal plants in the light of their continuing social and cultural relevance. On the one hand, the growing economic importance of this bio-cultural resource and, on the other hand, threats to its survival necessitated the launching of these programmes.

According to our understanding,

- Biodiversity and cultural diversity go hand in hand and the erosion of local health cultures hastens the loss of biodiversity.
- Revitalization of medicinal plant-based local health cultures holds the key to re-establishing the "health security" of resource poor rural people, their livestock and crops.
- Use of ecosystem specific medicinal plants is a very important poverty alleviation strategy for health and livelihood security.

An essential feature of our programmes is the benefit sharing with stakeholder communities so that they also gain from the programme for conservation of medicinal plants and revitalization of local health traditions. It is based on the understanding that rural communities, women and tribals are the key custodians of medicinal plants and indigenous knowledge and that they stand to benefit from their conservation and revitalization.

In order to meet the primary healthcare (PHC) needs of their household members, livestock and crops, FRLHT instituted a community driven outreach programme, i.e., the Home Herbal Garden (HHG) programme.

In a few areas, the plants in home herbal gardens are also used to treat the common health problems of cattle. The promotion of ethnoveterinary medical traditions through the HHG programme was undertaken with the support of the District Milk Unions (DMUs) in select districts of Karnataka and with the support of the National Dairy Development Board (NDDB), Southern Regional Office, Bangalore.

Before the above programme was initiated, a total of around 116 plant species for nearly 19 health conditions that are commonly seen in cattle were documented and taken for assessment in different geographical locations: Tiptur, Dharmapuri, Madurai and Wayanad. The basic principle of this assessment is to get a consensus of opinion among different medical systems about the management of a health condition. It was found that nearly 70% of the practices had supporting evidence in Ayurveda and modern pharmacology on their prescribed uses. It was also found that 55% of those positively assessed plants are easily available locally in each of the bio-geographical locations and can be grown in homestead gardens.

FRLHT initiated the promotion of ethnoveterinary medicine from 2001 to 2005 in Dakshina Kannada, Karnataka. This was considered by NDDB to be one of the measures to reduce the cost of milk production to dairy members on the one hand and to improve the quality of milk for consumers on the other. The Dakshina Kannada District Coop. Milk Producers Union (DKMU) extended its full support and co-operation for the implementation of the programme. The dairy members implemented the pioneering programme to introduce ethnoveterinary medicine, through the HHG programme. The HHG programme was a part of their strategy for decentralization of animal healthcare services under the aegis of the "Clean Milk Production" scheme launched by NDDB through its Southern Regional Office in Bangalore. In fact, the DK Milk Union team went a step further and supported the establishment of Parampara Herbal Producers Company, which will soon make available ready-to-use herbal products to meet the healthcare needs of their dairy members and their livestock.

Methodology

Participatory documentation and rapid assessment of ethnoveterinary medical Traditions

The first step was to document and assess the ethnoveterinary remedies that were found to be safe and efficacious. The participatory documentation and rapid assessment of local health traditions makes it possible for the local communities to build on their orally transmitted indigenous knowledge on veterinary care. This

process also helps to add value to indigenous health knowledge with the help of practitioners from the formal and legal Indian systems of medicine such as Ayurveda, Siddha and Unani. Modern pharmacological studies and results along with the expert opinions of allopathic practitioners are involved in the participatory assessment of the use of medicinal plants that are referred to in the documented ethnoveterinary traditions for a list of top 14 prioritized animal health conditions.

The method of assessment of ethnoveterinary medical traditions is rapid but rigorous. If such an assessment were to be based on *in vitro*, animal or *in vivo* tests, it would have to involve considerable years of research and millions in investment. This is just not feasible in the context of the resource constraints already experienced by most developing countries such as India. It must also be borne in mind that these are living traditions that have been passed on across several generations and have perpetuated themselves because of their safety and effectiveness but have just not yet been researched by modern science. The selection of a sound and effective home remedy is primarily based on

a. Community feedback relating to repeated use and effective relief;
b. Literature evidence from the pharmacopoeias of the established legal systems of Indian medicine, i.e., Ayurveda (and/or Siddha or Unani or Swa-rig-pa);
c. Confirmation based on the understanding of expert practitioners of Indian systems of medicine, i.e., Ayurveda (and/or Siddha or Unani or Swa-rig-pa);
d. Evidence (if available) from modern allopathic medicine and pharmacology.

The documentation and rapid assessment of ethnoveterinary medical traditions are a participatory methodology. In this methodology, sound and effective ethnoveterinary remedies are selected with the involvement of ethnoveterinary practitioners, dairy members, veterinary officers and physicians of Siddha and Ayurveda. The methodology was developed, pilot tested and implemented by FRLHT in 2000 on the basis of the Conservation Assessment and Management Plan (CAMP), which was used as a rapid assessment tool. The CAMP was developed as per the CBSG (Conservation Breeding Specialist Group)/IUCN guidelines that have been demonstrated intensively in India, Costa Rica, Panama, Indonesia, Thailand and other countries (Walker and Molur, 1998).

The ethnoveterinary remedies that are assessed as sound and effective through documentation and rapid assessment exercises are promoted through the HHG programme with the help of the Lady Resource Persons (LRPs) affiliated to the DMUs. The assessed remedies are promoted by the LRPs through village level training in the growing and use of medicinal plants for the PHC needs of livestock.

The programme for the promotion of ethnoveterinary medical traditions addressed the following needs of the selected communities.

Lack of awareness about the contemporary relevance of ethnoveterinary medical traditions in veterinary healthcare.

a. Lack of knowledge and availability of medicinal plants for growing in home herbal gardens and using them as home-based ethnoveterinary remedies for basic veterinary healthcare needs.

b. Lack of trained resource persons to train rural households in the use of home remedies for basic veterinary healthcare.
c. Lack of resources of medicinal plant seedlings to be planted in the home herbal gardens.

Home Herbal Garden programme

The HHG programme is implemented through a decentralized strategy of sharing the responsibilities between the key role players. The LRPs selected by the women self-help groups (SHGs) affiliated to the DMUs coordinated the implementation of the HHG programme. The HHG plants package also served the PHC needs of their household members. Table 1 shows the roles and responsibilities of the various stakeholders involved in the implementation of the HHG programme.

Table 1. The roles and responsibilities of the various stakeholders involved in the implementation of the Home Herbal Garden programme

Activity	Role of DKMU	Role of SHG	Role of LRP	Role of FRLHT/BAIF
Effective remedies to be promoted through HHGs based on DALHT (Documentation and Rapid Assessment of Local Health Traditions)	Organize the DALHT workshop and bring out the report on the assessment of local ethno-veterinary medical traditions, giving the details of safe and efficacious remedies to be promoted	Assist the DMU in identifying the ethnoveterinary practitioners and knowledgeable persons from their respective villages to participate in the workshops and share knowledge, practices, skills and experiences	Assist the DMU in documenting ethno-veterinary medical traditions	FRLHT assisted DKMU conduct the DALHT of the ethno-veterinary medical traditions based on Ayurveda.
Selection of medicinal plants species for propagation in nurseries, on the basis of effective ethnoveterinary remedies for basic veterinary healthcare selected through DALHT	Provide training to nursery entrepreneurs identified by SHGs to establish and manage the medicinal plant nurseries	Identify nursery entrepreneurs interested in establishing and managing medicinal plant nurseries	Support nursery entrepreneurs in the establishment and management of medicinal plant nurseries	FRLHT assisted DKMU provide training to the nursery entrepreneurs
Training of trainers, i.e., LRPs	Provide training to LRPs in establishment,	Identify LRPs interested in helping their	Attend the training of trainers	FRLHT assisted DKMU train their trainers

	maintenance and use of HHGs for PHC complaints of human beings and their livestock	villages/ house-holds in establish-ing, maintaining and using HHGs for PHC com-plaints of human beings and their livestock	programme	with the help of the BAIF Institute of Rural Development (Karnataka), Tiptur
Training of household women by LRPs in establishment, maintenance and use of HHGs	Coordinate training of household women by LRPs, including the demonstration of the preparation of home-based remedies in their villages	Identify household women interested in establishing, maintaining and using HHGs for PHC complaints of human beings and their livestock	Conduct the village level training of household women interested in establishing, maintaining and using HHGs for PHC complaints of human beings and their livestock	Nil
Supply of medicinal plant seedlings from nurseries	Coordination between nursery entrepreneurs, SHGs and LRPs about schedule of supply of medicinal plant seedlings	Indent payment of advance, transportation and distribution of medicinal plant seedlings from nurseries	Monitoring of fencing, domestic waste water channels, digging of pits prior to supply, planting, maintenance, use of medicinal plants, collection of money from households	Nil

Effective ethnoveterinary remedies, selected through a process of Documentation and Rapid Assessment of Local Health Traditions (DALHT), are promoted through the HHG programme, which consists of the following steps:

1. Selection of medicinal plants species for propagation in nurseries
2. Training of trainers, i.e., LRPs
3. Training of household women in establishment, maintenance and use of HHGs
4. Supply of medicinal plant seedlings from nurseries

Medicinal plants were selected for the HHG package on the basis of the following criteria:

- Ease of diagnosis of PHC conditions for which they can be used
- Plants are safe and free from any known toxicity
- Plants are ecosystem compatible, that is, they are easily available or can grow easily
- Only limited number – one to three plant ingredients – are needed to prepare the remedy
- Ease of preparation of remedy made from the plants
- Ease of administration of remedy made from the plants

Results of the Home Herbal Garden programme

Table 2. A few examples of PHC complaints of human beings and their livestock and the medicinal plants grown and used by HHG households to relieve them

S. no.	PHC conditions of human beings for which LHT uses are prevalent in Dakshina Kannada	Basic veterinary healthcare conditions for which LHT uses are prevalent in Dakshina Kannada	Medicinal plants supplied, grown and used	Parts of plant used
1.	Minor cuts and wounds, gastritis	Minor cuts and wounds, mastitis, infertility	*Aloe vera*	Leaves
2.	Fever, immunity	Fever, immunity	*Tinospora cordifolia*	Stem, leaves
3.	Viral fever, cold and cough	Viral fever, cold and cough	*Ruta graveolens*	Leaves, whole plant

LHT - Local Health Tradition

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An Initiative towards the Conservation and Development of Indian Cattle Breeds

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Abstract

India has a rich biodiversity, which also includes the cattle population. Owing to the "White Revolution" and extensive crossbreeding programmes in India, the native cattle breed population has decreased and some breeds are facing extinction. At the same time, the values, knowledge, ethnoveterinary practices, healers and the local biodiversity associated with these breeds are not being given proper attention. The culture of dairying has become the dairy business.

Most farmers in the dairy business do not find it an economically viable proposition. The external dependency for food, concentrate, fodder and health protection is increasing. Farmers are in search of alternatives. Hence, Krishi Prayoga Pariwara (KPP) started looking at the importance of Indian cattle breeds and their relevance today.

KPP carried out a literature survey, visited villages, talked to experienced farmers, social workers and veterinarians. On the basis of this, KPP brought out a small publication on Indian cattle breeds, which inspired a number of farmers to start conserving and developing native cattle breeds. A mega project named "Kamadugha" has been initiated by Sri Sri Raghaveshwara Swamiji of Sri Ramachandrapura Mutt at Hosanagara of Shimoga district to conserve and develop Indian breeds.

This paper briefly introduces Indian cattle breeds, and discusses their importance, the cultural values associated with them, the Ayurvedic properties of various cow products and the importance of cow products in agriculture and for human health.

India is blessed with a rich biodiversity. There is also a diverse livestock population. There are 30 indigenous cattle breeds, 12 buffalo breeds, 20 breeds of goat, 40 breeds of sheep, 6 breeds of horse, 8 breeds of camel, 3 breeds of pig and 18 breeds of poultry. Quite a large number of farming families including marginal and small farmers and, landless labourers use livestock for varied purposes to sustain their livelihood.

Indian farmers keep cattle and other animals as a source of milk, manure and fuel and also for ploughing and carting. Apart from this, farmers respect the cow as Gomatha, and it has a rich cultural significance for them. Livestock has contributed significantly to the development of agriculture in India and is still contributing much to agriculture. However, because of the "Green Revolution" and "White Revolution" in India, the situation is changing significantly. Over the years, the population of indigenous cattle has declined (Table 1).

Table 1. Trends in cattle population in India

Category	Cattle population [millions]				Annual growth rate [%]		
	1987	1992	1997	2003*	1987–92	1992–97	1997–03
Indigenous	188.28	189.37	178.78	156.87	+1.06	–1.12	–2.04
Crossbred	11.59	15.21	20.10	22.07	6.25	6.43	1.63
Total	199.69	204.58	198.88	178.94	+0.49	–0.56	–1.68

* Provisional data

The overall annual growth rate in the cattle population from 1992–2003 was –1.14%. The annual growth rates for indigenous and crossbred cattle were –1.56 and +5.65, respectively. As per the provisional 17th Indian livestock census 2003, in 2003 there were only 156.85 million indigenous cattle as compared with 178.78 million and 189.37 million in 1997 and 1992, respectively. Conversely, the population of crossbred cattle has increased from 15.21 million in 1992 to 22.07 million in 2003 (Gandhi and Singh, 2006).

The situation in different states is similar to the overall status in the country. In Karnataka, there has been a marked reduction in the number of indigenous breeds. Some of the known Indian breeds are on the verge of extinction. The number of Krishna valley breed cattle has come down by 97.96% and that of the Deoni breed has come down by 72.22%. The number of Hallikar breed has come down by 39.97%, Kilari breed by 30.89% and Malenadu gidda breed by 24.96% (The Hindu, April 16, 2005). At the same time, the population of crossbreeds has increased by 41%. In the Shimoga district, in 2003, the population of indigenous cattle was 48,718 and that of crossbreeds was 56,588. In short, indigenous breeds comprise only 46.26% of the total cattle population. This situation is alarming. The diverse genetic base is becoming narrow, which is a threat to sustainable agriculture. If the population becomes uniform, its vulnerability to pests and disease will increase.

The village scenario

Krishi Prayoga Pariwara (KPP) is working in villages of the Shimoga, Chickmagalur and Uttara Kannada districts of Karnataka, especially in the Western Ghats. The example of the situation in Hulegaru village of Shimoga district is considered. Here, in April 2005, the population of crossbreeds was 46 and that of indigenous cattle was 100. The farmers feel that keeping crossbreeds is not a good proposition since there are many difficulties associated with them. The difficulties as expressed by farmers are

1. Crossbred animals are often prone to disease and pests. Hence, veterinary care becomes a priority and the cost associated with veterinary care for crossbreeds is relatively high compared with that for native breeds.
2. Crossbred animals require a higher quantity and quality of concentrate and fodder. Farmers have to grow fodder crops on their limited agricultural land, which involves no small investment in terms of fodder seeds, manure, labour etc. The

requirement of a higher quantity of concentrates also demands explicit expenditures. Thus, crossbreed animal rearing is capital intensive.

3. The risk of mortality is higher in crossbreeds compared with indigenous breeds. Hence, if a crossbred animal dies, farmers will incur a loss of around Rs.5000–1000, depending on the milk yield of the animal, which is very high compared with the risk involved in rearing indigenous breeds.
4. The average milk yield of crossbreeds is only around 5–6 l/day, which is an economically unviable quantity. At the same time, proven milch breeds of India also produce similar quantities of milk. Selected local animals of Malenadu gidda have a milk yield close to this figure.

Considering the above difficulties, the option of rearing crossbred animals is not an economically viable proposition.

Apart from the above disadvantages of crossbreeds, the introduction of these breeds has also brought about some changes in villages. The crossbreeding programme called for mass castration of native non-descriptive inefficient bulls. At the same time, farmers were also attracted by the insemination programme readily available on their doorstep. This has resulted in the loss of bulls of native breeds since rearing a bull is very costly. The changed pattern in the tenancy system and the cropping system has also resulted in farmers giving less importance to the rearing of bulls of native breeds. At present, the loss of selected bulls has meant that there is no option other than to go in for crossbreeding. Local cattle are more resistant to local pests, diseases and are adjusted to the local environment. Whenever these cattle are affected by disease or pests, local ethnoveterinary practitioners can manage them using the herbs that are grown locally in farms or are available in forests. Introduction of crossbreeds has lessened the importance of local healers. The knowledge of these healers is vanishing along with them. The knowledge of using locally available bioresources and its importance is also eroding significantly.

R. S. Gandhi and S. Singh (2006) noted in their article that crossbreeding in India has led to

1. A departure from the accepted breeding policy framework for indigenous breeds, resulting in the erosion of indigenous genetic resources as animals of native defined milch breeds were not used for crossbreeding.
2. Ingression of many infectious diseases like infectious bovine rhinotracheitis (IBR) and Bluetongue from temperate regions, which were not prevalent in tropical countries.
3. Cattle with a higher susceptibility to diseases prevalent in tropical environments like foot and mouth disease, mastitis and tick-borne diseases.
4. Higher incidence of reproductive disorders like anoestrous and repeat breeding in crossbred cattle.
5. Higher cost of maintenance and sustenance *vis a vis* feeding and veterinary services.

Thus, even though the introduction of the crossbreeding programme in India has resulted in increased milk production over the years, from 20 million tons in 1970 to 91.5 million tons in 2004, it has led to a number of drawbacks. The villagers are looking for better alternatives.

Hence, KPP started to look at the problem in detail. It carried out a detailed literature survey looking into the strengths and weaknesses of indigenous cattle breeds and crossbreeds, breeding policies over the years, the cultural significance of cattle to rural families and the use of animal products in agriculture and for maintaining human health. KPP had a series of interactions with farmers in its project area and with local successful dairy farmers, local veterinary healers, veterinary doctors, veterinary scientists, academicians, policy makers etc. The findings were presented in a small booklet called *"Namma Kamadhenu"*, which was distributed to various stakeholders.

Indian cattle breeds

There are around 30 descriptive or recognized cattle breeds in India according to the latest calendar of the Indian Council of Agricultural Research (ICAR) on "Cattle Breeds of India", published by the National Bureau of Animal Genetic Resources (NBAGR). They are *Amritmahal, Hallikar, Deoni, Khilari, Krishna valley, Ongole, Punganur, Vechur, Baragur, Kangayam, Bachaur, Dangi, Kenkatha, Kherigar, Malvi, Nagori, Nimari, Ponwar, Siri, Gir, Red Sindhi, Sahiwal, Gaolao, Hariana, Kankrej, Mewati, Rath, Tharparkar* etc. Out of these, *Vechur, Punganur, Bachaur, Krishna valley* etc. are on the verge of extinction. These breeds were developed over millennia for varied purposes like milking and agricultural purposes, under varied agroclimatic conditions. These breeds are well adapted to local conditions, have good pest and disease resistance and are adjusted to local feed and fodder. Most of these breeds have also played a very important role in major battles during the struggle for independence.

Indian breeds are *Bos indicus* cattle and are characterized by a large hump over the top of the shoulder and neck. Spinal processes below the hump are extended, and there is considerable muscular tissue covering the processes. The other characteristics of these cattle are their horns, which usually curve upward and are sometimes tilted to the rear; their ears, which are generally large and pendulous and the throatlatch and dewlap, which have a large amount of excess skin. They also have more highly developed sweat glands than European cattle (*Bos taurus*) and so can perspire more freely. Indian cattle produce an oily secretion from their sebaceous glands, which has a distinctive odour and is reported to assist in repelling insects. The hair, coat, pigmentation, ability to sweat, loose skin and internal body heat are some of the unique characteristics of Indian cattle that help them to survive adverse climatic conditions.

Apart from the descriptive breeds, there are a number of non-descriptive breeds in India. It should be noted here that continuous efforts have been made over the years to develop these descriptive breeds. As an example, the *Amritmahal* breed of Karnataka is considered.

Amruthmahal

Amruthmahal is a special breed of Karnataka and has a history of over 500 years. The credit for developing this breed goes to the Ambassador of Vijayanagara Kingdom in Srirangapatna near Mysore in the 16th century. After him, Mysore Odeyar (King of Mysore) further developed this breed for milk and for the security of the state. His Excellency Chikdevaraj Odeyar developed special pasture lands for grazing the breed. It was then known as *"Bennechavadi"*. It was further developed during the Hyder Ali

and Tippu Sultan period. Tippu renamed the breed *"Amruthmahal"*. After that, it came under British rule. Mummadi Krishnaraja Odeyar developed this breed once again in 1866. At present, the Karnataka Government has an Amruthmahal Conservation Centre at Ajjampura in Chickmagalur district.

The bullocks of this breed are very active with sharp eyes. The bullocks can pull carts continuously for 14 hours. Records say a bullock pair can pull a one-ton load continuously for 8 to 10 hours. The bullocks were involved in various armies of Hyder Ali, Tippu Sultan and Mysore Odeyar. These bullocks played a major role in the victories of these Kings. A number of British reports also highlight the importance of these bullocks in those days.

Now the population of this breed is very small. The Government has around 2000 animals of this breed and there are a few with farmers. Selected milk breeds of Amruthmahal yield 4–6 litres of milk per day. So, concentrated efforts should be made to conserve and develop this breed once again.

Vechur

Vechur is a native breed of Kerala. It originated in a village called *Vechur* in the Vaikom taluk of the Kottayam district of South Kerala. The heavy rainfall and the hot humid climate of the area led to the natural selection of a small animal. *Vechur* bulls with their small size and light weight but with their strong stature are suitable for ploughing marshy paddy fields. The popularity of the *Vechur* cows lay in the fact that their milk production was relatively high compared with that of other local cows. The Travancore State Manual of 1940 by T.K.Velu Pillai made a special mention of *Vechur* cows. The extremely small size of the cows, their low feed requirement, their good adaptability and high disease resistance are traits very much favoured by farmers. The milk of Vechur cows was considered as having a high medicinal value and was extensively used in the Ayurvedic system of medicine.

Massive crossbreeding programmes taken up by the Kerala government since the 1950s have transformed the local animals in the State to crossbreeds. Local bulls were not permitted to be retained as per the Kerala Livestock Act, 1961. The Act stated that "No person should keep a bull for breeding if it attains a particular age except with license and other terms and conditions unless certified to be castrated". The Act covers the entire male cattle population that has reached breeding age, whether they are retained for breeding purposes or not. But bulls dedicated to the temples were exempt from the provisions of the Act. Thus, the Siva Temple of Vaikom has played a role in averting the extinction of the breed.

The World Watch List of Domestic Animal Diversity, published by the FAO, has listed *Vechur* cattle under the category of Critical Breeds, meaning nearly extinct. The credit for bringing Vechur cattle from the brink of extinction goes to a conservation programme undertaken by the Kerala Agriculture University (KAU). Subsequent to studies conducted by the KAU, *Vechur* cattle are now recognized as the smallest cattle in the world. Before the *Vechur* caught the attention of the scientific community, a Mexican cow measuring 1 m in height was considered to be the smallest. The maximum height of a Vechur cow is 91 cm. This diminutive cow, weighing on an average 107 kg, can give an average yield of 3 litres of milk per day, which is the yield of the Mexican cow too. Thus, considering its body weight, the *Vechur* cow has the maximum milk yield in the world.

Detailed characterization studies of *Vechur* cattle have been taken up by the KAU. The acrocentric nature of the Y-chromosome establishes that *Vechur* cattle belong to the Zebu species of cattle (*Bos indicus*), which is different from European cattle (*Bos taurus*) as they have a metacentric Y-chromosome. Calf mortality has been found to be almost nil in *Vechur* cattle under farm conditions. It has also been observed by the scientists of the KAU that these dwarf animals are quite resistant to foot and mouth disease and mastitis, two diseases that play havoc with hybrid cows in Kerala. Compared with crossbred cows, significantly lower incidences of respiratory infections have been reported in *Vechur* cattle. The gene(s) responsible for these qualities is India's insurance for the future. The animal breeders of tomorrow may require this gene to save Indian cattle wealth from total liquidation by pests and germs.

Milk analyses carried out in the KAU now support the empirical findings of unknown Ayurvedic physicians. The percentage of fat and total solids in the milk of *Vechur* cows is high compared with that in the milk of crossbred cows. But a more significant aspect is the size of the fat globules. The mean size of a fat globule in the milk of the *Vechur* cow (3.21 microns) is higher than that of the goat (2.60 microns), but considerably smaller than that of crossbred cows (4.87 microns) and of Murrah buffalos (5.85 microns). The small size of the fat globules means that there is a high phospholipid content because of the greater surface area. Phospholipids are important in the development of brain and nerve tissues, and they also play a vital role in the absorption and digestion of fat.

Since the milk of the *Vechur* cow has got a higher proportion of small fat globules and saturated fatty acids, it can be therapeutically useful in cases of malabsorption syndrome. Thus, the milk of the *Vechur* cow and the products made from that milk are suitable for infants and the sick. In general, *Vechur* cattle are an ideal choice for farmers who cannot afford sophisticated dairy management practices but want just enough milk for home consumption. (Courtesy: *Vechur* Conservation Trust website and a feature by Sri Uthaman published in http://pib.nic.in/)

Other Indian breeds have been developed in different parts of India and are used for either milk or draught purposes or sometimes for both. India had good milch breeds like the *Gir, Red Sindhi, Hariyana*, and *Sahiwal*. The Gir used to give 1600 kg milk per 300-day lactation period, whereas the *Sahiwal* used to give 2700 to 3200 kg milk per lactation period. The best yield on record for the *Red Sindhi* is 5400 kg and that for the *Sahiwal* is around 4500 kg. India had good draught animals like the *Hallikar, Krishna valley, Dangi, Malwi* etc. *Tharparkar* is a special breed of cattle that can cross the Thar dessert by walking continuously for more than 24 hrs. *Nagori* is also another breed that is well suited to desert areas. Unfortunately, the policy makers did not recognize these qualities during the crossbreeding programme. The ultimate aim of the programme was only to improve milk production. Other traits like adaptability to local feed and fodder, total fat and SNF content of the milk, resistance to disease and pests, other special qualities etc. should also have been considered in crossbreeding. It is also noteworthy that the chemical composition of the milk of indigenous breeds significantly differs from that of Holstein Friesian (HF) or Jersey (Table 2).

Table 2. Chemical composition of milk

Composition [%]	Indigenous	HF	Jersey
Fat	4.5–4.6	3.4	4.5
Protein	3.1–3.45	3.22	3.42
Total solids	12–14	12.26	13.5
Caesin	2.4–3	2.4	2.7
Lactose	4.8–5.1	4.87	4.93
Ash	0.66–0.74	0.68	0.71
B-lactoglobulin	0.3	0.25	0.25
Sterols	0.2–0.3	0.3–0.4	0.3–0.4

The above table shows that the milk of indigenous breeds has a better or comparable fat, protein and total solids content and caesin, lactose and ash percentage. The beta lactoglobulin, which improves resistance in humans, percentage is better and the sterol (cholesterol lanosterols) content is less. Thus, quality-wise, indigenous breeds have an edge over crossbreeds.

Malenadu gidda is a non-descriptive breed in a KPP area in the Western Ghats of Karnataka. Farmers remember that selective cows of this breed used to give 3 litres of milk per day. The breed is very well suited to this hilly tract and high rainfall area. It is also a small sized animal. The animal is resistant to foot and mouth disease and mastitis. Efforts have to be made to characterize this breed and also to selectively breed it.

Cultural significance

The cow is considered as *Gomatha* and is worshipped every day. Hindu farmers will not allow the animal to be slaughtered and will not eat beef. Farmers consider cattle sacred and have an emotional attachment to them. The cattle population is the wealth of the family. The higher the population of cattle, the wealthier the farm family.

Cow products like cow urine, cow dung, milk, ghee and curd are used in most rituals including birth and death ceremonies performed by these Hindu families. Farmers use *Dharoshna*, or unpasteurized, milk during the daily worship of family deities and used to consume it because they considered it sacred. This custom is slowly disappearing since it is dangerous to consume the unpasteurized milk of crossbreeds because it could carry infectious microbes like that of tuberculosis. During *Gruhapravesham*, a lactating cow along with its calf is the first to be taken into the house. *Godana* (gifting a cow) is one of the most sacred activities of a family. *Godana* is also associated with a number of Hindu rituals. People still mostly use the

native breeds for all rituals and are more emotionally attached to these rather than to crossbreeds.

Cow products are also used for local health practices. There is a local practice of giving cow urine on Thursdays and Sundays to small children who have the habit of regular excess saliva secretion. Traditionally, small children are bathed with buffalo dung. People with lice in their hair used to bathe in cow urine.

However, the emotional attachment to the cow has altered slightly after the introduction of crossbreeds. Farmers and others have started to look at cattle solely in terms of the monetary aspects of milk production. Associating with the animals as a part of their life has slowly turned into a way of earning income by selling milk. Cost and profit calculations with respect to only milk production in cattle rearing have resulted in a higher acceptance of crossbreeds than the native breeds. Because of this loss of emotional attachment, sacred feelings are slowly disappearing and this also has influenced the rural lifestyle. Hence, there is a need to educate farmers and raise awareness among them on all aspects of indigenous breeds and their importance for their own sustenance and for the nation.

Properties of animal products as seen in Ayurvedic texts

There are a number of Ayurvedic texts that refer to the qualities and use of animal products. *Charaka samhita, Sushruta samhita, Astanga sangraha, Astanga hridaya, Dhanvanthari nighantu, Bhavaprakasha* etc. have a number of references to these products. For example, they have references to

Cow's milk

- *Madhura, vata – pitta nashaka, guru, raktha vikara nashaka.*
- The milk of black and red cows is vatha shamaka, yellow pittashamaka. And that of white cows is *kaphakaraka* and is *guru* (heavy to digest).
- The milk of a cow with a very young calf or of a cow with no calf is *tridoshakaraka*.
- The milk of a cow that eats less feed and fodder is guru. It improves strength and vitality.
- Milk should not be eaten along with fish, meat and radish.

Buffalo milk

Buffalo milk is sweeter than cow's milk: *Shukrala, nidradayaka, kapha vardhaka* and *sheetala*.

Curd from cow's milk

Curd made from cow's milk is madhura and sour in taste: *snigda, agnideepaka, hrudya, vatanashaka, malarodhaka* etc.

Curd from buffalo milk

Curd made from buffalo milk is madhura in taste: *kaphakaraka, vata – pittanashaka, shukrala, shramanivaraka.*

Buttermilk made from cow's milk

Tridosha nivaraka, agnideepaka, ruchikaraka, buddivardhaka, udararoga nashaka.

Buffalo buttermilk

Kaphakaraka, pleeha roganashaka, athisarahara.

Cow dung

Cow dung is *rakshoghna*, bitter and *ogaru* in taste and is used especially to treat *kapha* diseases and is also useful in controlling skin diseases.

Cow urine

Katu, pitta rasayuktha, laghu, Aanideepaka, pittakaraka, kapha-vatanashaka. Cow urine is used to treat diseases of the stomach.

The series of references on various animal products and by-products shows that Ayurvedic scholars found these products useful in the treatment of many human diseases and disorders. This was a useful low-cost local resource that helped the local community maintain their health using indigenous knowledge. Pundit Sri Revashankar Sharma of Rajasthan prepares a number of medicines using cow products. To name a few, *Gomuthrasava* for leucoderma, *Gomuthra arka* for decreasing blood cholesterol, *Gomuthra ghanavati* for blood pressure, stomach disorders etc. Farmers used to prepare tooth powder from cow dung flakes. Recently, there are many articles on the use of cow urine to treat cancer. "Ahimsak Kheti", a Hindi monthly on organic agriculture, has reported a case, giving all clinical details, of cancer being cured with gomuthra (1999).

Animal products are widely used in agriculture for varied reasons. One of the major uses of animal products, which helps in the maintenance of soil fertility, is as farmyard manure or as compost. This is a major component of organic farming. There are number local techniques for spraying cow urine to improve crop growth and yield. But till date, very few systematic efforts have been made to validate these techniques. Now, we have a short term project under the Compas programme for this purpose. There will be a few results at the end of this year, 2006. A study conducted recently by the students of a college in Shimoga showed the antimicrobial properties of cow urine.

So, indigenous breeds are important owing to their contribution to various aspects of rural life. An effort to convey this message to Indian farmers was made through the publication of a booklet titled *"Namma Kamadhenu"*. This has kindled the spirit of many farmers to take a fresh look at Indian indigenous breeds. A mega project called "Kamadugha" has been undertaken by Sri Sri Raghaveshwara Bharathi Swamiji of Ramachandrapura Mutt at Hosanagara, Shimoga district. The main aim of the project is to conserve and develop Indian cattle breeds. They have undertaken a mass campaign programme in the state and have conducted a 64-day *Goyathra* – spreading the message of the importance of the cow and indigenous breeds to life in India. The Mutt has a conservation centre where 23 Indian breeds are reared. There is a *Gavya Chikitsalaya* where patients are treated with cow products, and records are regularly maintained. There is also a unit producing cow-based products used specially

for maintaining health. The project educates people on the current scenario, the Indian way of looking at cows, the differences between indigenous cattle and crossbreeds and, the need of the day, the conservation and development of these breeds suitably in their own areas.

Apart from this, there are a number of efforts in various parts of the country to conserve and improve local indigenous breeds. Even the 10th Five Year Plan of the country (2002–07) stresses on the need for conservation of local breeds. The NBAGR, Karnal is working on the conservation and development of indigenous breeds.

Future tasks

Looking at the drawbacks of the present crossbreeding programme and the importance of indigenous breeds to all aspects of the life of rural people, a proper breeding policy should be evolved. The policy should aim to

1. Increase milk production but with broad a genetic base that takes into consideration traits like adaptability of breed to local conditions, resistance to pests and diseases, capacity to convert available feed and fodder, any other special characteristics etc.
2. Identify, select and produce bulls of indigenous breeds, taking into consideration all the traits listed above.
3. Characterize and evaluate some of the non-descriptive breeds of the country that are efficient in milk production and have all the other associated positive characteristics.
4. Make available at all artificial insemination centres the semen of proven indigenous breeds.
5. Carry out research work on the use of animal products in agriculture and in healthcare.

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Traditional Veterinary Knowledge of Sri Lanka

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Abstract

Ethnoveterinary practice (EVP) is a practice that has come a long way in the history of Sri Lanka. This has been carried out particularly by farmers in remote areas. Indigenous veterinary medicinal treatments are low cost, easily accessible and environment friendly as the necessary herbal plants and extracts can be found in the surrounding lands. After the arrival of western medicine, EVPs gradually started eroding, because of which cattle farmers now face lots of problems such as difficulty in accessing veterinary personnel, unbearably high treatment costs etc.

Historical background

Before the intervention of the British, Sri Lankan kings were very interested in livestock and EVPs. Therefore, they extended immense support and co-operation to EV practitioners. Ethnoveterinary practice became very popular not only for cattle but also for elephants and other animals. By way of appreciation, the kings awarded lands to EV practitioners and gave them the prestigious name of "Wana Sundara".

Rural farmers still prefer indigenous veterinary practices to western treatment methods. Therefore, Future In Our Hands (FIOH) has gathered information for the purpose of revitalizing these practices.

Since the year 2003, FIOH has identified more than 25 EVPs in their operational areas. Various cattle diseases and the symptoms of those diseases were identified by the EV practitioners, farmers and healers of Uva Province by having meetings and discussions. As alternatives to western medicines, various simple home remedies and simple herbal treatments are used by the rural community of Sri Lanka.

These practices are carried out with a combination of spiritual, astrological and physical aspects.

The identified diseases and treatments were discussed with experienced and knowledgeable cattle farmers, and they too agreed that these methods were very effective and successful. Thereafter, the collected data were published in a booklet, and workshops were conducted for cattle farmers, and also these data were brought to the attention of the Uva Provincial Council Members, veterinary surgeons and the Commissioner of Ayurveda. This presentation highlights the experiences and some of the interesting findings of the study.

The relationship between animals and human beings can be traced back to the beginning of civilization. Each civilization had its own space for animals. Certain civilizations saw animals as divine beings and even worshipped them.

Medical treatment for animals basically started with their domestication. The traditional knowledge related to ethnoveterinary practices (EVP) should be seen in the background of the world-view of the communities that developed and perfected them.

Sri Lanka had a rich knowledge of animal health and treatment methods. According to the legends, the history of EVPs goes back to the Ravana era, when there was a famous doctor "Sushena" who treated animals. It was also known that when Arahat Mahinda brought Buddhism to Sri Lanka, he was accompanied by Ayurvedic doctors who treated domestic as well as wild animals.

There was king called Buddhadasa (337–365 BC), who was a well-known physician and who treated both humans and animals. This indicates the social status given to medical practitioners at that time. Some of the kings in Sri Lanka paid special attention to animal treatment. The kings in Sri Lanka, awarded lands to EV practitioners, and for their services, they were given the prestigious name *Wana Sundara*. The house of a practitioner was known as *Weda-Gadera*, "medical house", and the practitioner was known as *Weda Mahattaya*, "medical practitioner".

The world-view

In general, the world-view of communities influenced the way people looked at and treated animals. Since the introduction of Buddhism, Sri Lankan society respected *ahimsa* with respect to human beings as well as animals. Killing animals was considered a sin and eating meat was unacceptable and thought sinful. (The first of the five precepts a Buddhist should follow always is "refrain from killing".) *Karaniya Mettta Sutta*, a well-known discourse of Lord Buddha, is a household name in Sri Lanka even today. The *Sutta* is about spreading loving kindness to all beings. So, in general, according to this world-view, animals should be looked after, and in case of illnesses, they should be treated the same as human beings.

In the case of human beings, health aspects were combined with the belief system of "good living", which mostly meant "religious living". Specifically, it included "refraining from eating meat". At the same time, a major part of good living was ascribed to the previous *kamma* of a person. And in order to sustain good living, the person also had to accumulate *kamma* through good deeds. One of the major good deeds was to refrain from killing, and killing was a deed that accumulated bad *kamma* (*papa*).

Traditional treatment methods for human beings were combined with astrology, spiritual practices and then the physical medical treatments.

Traditional EVPs in Sri Lanka should be viewed in the light of the above belief system. As the killing of animals was taboo, raising animals for meat was not accepted. In order to accumulate good *kamma*, a person should not only refrain from killing but he should also treat and look after the welfare of animals. So, treating animals was considered as important as treating human beings.

A medical practitioner whether for humans or for animals had equal importance in society. Both were revered as *Weda Mahattaya* (medical practitioner). In most cases, the practitioner treating human beings was also able to treat animals.

This healing art and its practices were carried from generation to generation, both in written and oral forms. These practitioners played a vital role in society. They were considered to be of great service, and society respected them.

With the western influence, these practices started gradually eroding. "Veterinary doctors" were trained according to the western culture where animals are looked at as a major source of direct food (meat and milk). The government began to

patronize western treatment systems, and local knowledge was not recognized. The value given to EVPs was very low, and governmental support for developing or sustaining them was almost non-existent.

The farmers and animal keepers also began to depend on western treatment methods, at very high costs. The impact of using western veterinary knowledge was later understood by them. Western treatment methods have side effects such as the inducing of allergies, and they are very expensive and depend on imported drugs. Traditional EVPs are environment friendly, low cost, not money oriented and have no side effects. There is a mutual understanding between people and healers and the natural environment in the traditional system.

FIOH programme on revitalization of traditional knowledge and practices

Future In Our Hands (FIOH) has been involved in developmental activities in the rural areas of Uva Province for the last 20 years. Through its mobilization programme, it has found many indigenous knowledge based practices that exist in these areas related to agriculture and human and animal health.

Cattle rearing is practiced on a small scale and is popular among the rural community. Cattle are useful in many ways – in agriculture, transportation and milk production. The number of farmers who use traditional knowledge in farming has reduced in the post-colonial era. But there are farmers who are still using some form of traditional agricultural practices because they have seen the benefit of them. As in the case of agriculture, there are some cattle farmers still using EVPs, and the traditional knowledge has been preserved within the communities.

A few years ago, FIOH conducted participatory rural appraisal (PRA) programmes to identify and plan developmental activities. During this programme, the participating cattle farmers mentioned the problems they faced of inaccessibility of veterinary personnel and the high cost of western medical treatment.

During the same programme, FIOH also found many EV practitioners in these villages, but they were inactive because the wider community was unaware of their knowledge and practices. Some farmers used traditional methods for the primary healthcare of animals.

Documentation and highlights of findings

More than 20 healers, who possessed ethnoveterinary knowledge, were identified in FIOH operational areas. They inherited this healing art mostly orally from their forefathers. There are not many texts about these practices. Therefore, the healers together with FIOH decided to document this traditional practice.

With the identification of EV practitioners, FIOH started documentation of their knowledge and experiences.

This was done through individual discussions with the practitioners and by organizing a forum for them so that they could come together periodically and conduct group discussions. At the same time, information was also collected from the farmers about the remedies they used for cattle ailments.

The treatment system

The treatment system can be categorized into three parts.

1. **Using spiritual powers:** Chanting *pirith* (Buddha mantra), making offerings to local deities, yantras and mantras and kem rituals are used widely in EVPs.
2. **Using cosmic powers:** Use of astrology is also seen in this aspect. *Neketh* and *Karana* are widely used in the treatment of animals.
3. **Physical resources:** Plant components are used for the preparation of medicine. This is connected to the use of cosmic powers too. For example, extracting leaves or roots from plants is carried out using particular methods in order to enhance their healing qualities.

Documentation was carried out for the following diseases, symptoms and treatments: fever, diarrhoea, mucous diarrhoea; bloat, worm infection, cough, eye diseases, urinary disorders, mastitis, uterine disorders, snake bites, infertility, decreasing milk yield, hoof and mouth diseases, respiratory diseases, fractures, wounds, for easy removal of the placenta and some other diseases locally known as *Veppu* and *adappa* (there are 4,448 treatment conditions of *Veppu and adappa* in their practice).

One hundred and forty-eight treatments have been recorded for the above diseases/conditions. For each disease/condition, there are a number of treatments. They are based on locally available herbs and on the practical experience of the medical practitioners.

The treatment methods include oral drugs as well as applications of different preparations over the body/affected area.

Most of the treatments are combined with astrology, spiritual powers and cosmic powers.

Validation

Validating EVPs is a challenge. Most practices have a non-physical side that cannot be grasped in a western way of "validation". It is possible to carry out chemical analyses of most of the herbs used in treatments but that will not throw any light on the holistic nature of the treatment methods. Therefore, FIOH used the following methodology.

After collecting this information, the validation was conducted in the following ways. Firstly, the collected information was discussed among the cattle farmers who were the real users of the techniques. The farmers could clarify some of the methods during these discussions. At the second stage, the information was discussed with the selected experienced healers. During these discussions, consensus was reached and the methods were generally accepted as valid.

These discussions were facilitated by "resource persons" who possessed knowledge of traditional healing methods and were trained in western treatments.

After documentation, a few workshops were conducted for cattle farmers as well as for EV practitioners to share this knowledge. Through this process, farmers as well as practitioners shared and confirmed the effects of the healing methods documented during the research.

Promotion

The 20 selected diseases and treatments were published in a booklet, which is now available in the local language and is widely used by farmers. An English translation will be available shortly.

Rare medicinal plants were given to the *vaidya,* or healers, to develop their home gardens.

Support is provided for the preparation of readymade medicines, which are useful for easy treatment.

FIOH conducted workshops and training programmes to share the experiences of cattle farmers and EV practitioners and to learn to identify the biological conditions of animals from western veterinary surgeons.

Mainstreaming

FIOH organized an awareness programme on EVPs in Uva Province. This was attended by the Chief Secretary of Uva Province, Secretary to the Ministry of Indigenous Medicine, the Commissioner of Ayurveda, veterinary surgeons and farmers and healers who participated in this programme.

In this programme, the Indian experience on EVPs was also shared through a presentation made by the FRLHT team from India.

FIOH has supported a programme for handing over the knowledge to the next generation. Most of the healers have selected their sons or daughters to train to continue this practice; to encourage the young generation, FIOH is providing educational support.

To popularize these activities, FIOH has conducted/broadcast radio programmes on indigenous knowledge practices in agriculture and animal health on Uva Radio.

Attempts are being made to co-ordinate with Veterinary Department and university personnel and ministry officials to get recognition for these healing practices.

Farmers have indicated that most of these treatments can be used for primary healthcare of animals.

Towards A Pastoral Policy for the Protection of Pastoralists' Rights and for Conservation of Local Animal Breeds

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Abstract

For the last eight years, SEVA has been involved in the conservation of indigenous animal breeds in Tamil Nadu and has promoted herders groups/associations in the following breeding tracts:

i. Umbalacherry cattle breed in Nagapattinam district
ii. Malaimadu cattle breed in Virudhunagar district
iii. Katchakatti Karuppu black sheep breed in Madurai district
iv. Toda buffalo breed in Nilgiris
v. Vembur sheep breed in Thoothukudi district
vi. Pulikulam cattle breed in Madurai and Sivagangai districts

SEVA has initiated development work such as calf rearing programmes, community bull programmes, shed construction for animals, desilting of ponds to provide drinking water facilities for animals, periodical health check-up camps for animals, training programmes for livestock keepers to revitalize indigenous knowledge based health systems for animals (preparation of herbal medicines for animals) and addressing grazing problems.

SEVA is also one of the founder members of the Indian Pastoralists Network and prepared a Policy Note to protect pastoralists' rights, to provide livelihood support for pastoral communities and for in situ conservation of local animal breeds. SEVA has been invited by bodies of the United Nations such as FAO, Rome and the Convention on Biological Diversity to participate in the workshops on animal genetic resources held in Rome, South Africa, Spain and Brazil over the last 5 years.

Role of pastoral communities in India

Pastoralists are people who predominantly depend upon livestock keeping for their livelihood and who graze their animals on common property resources. Pastoralists are often nomadic or transhumant, but they can also be settled, depending on ecological conditions. Pastoralists often believe that they are looking after animals out of a god-given duty (the *Raika* caste is believed to have been created by Lord Shiva to look after camels; the *Yadhavas* and *Gujjars* are regarded as descendants of Lord Krishna and their traditional task is to take care of cattle; the life of the *Toda* tribe would be unimaginable without the daily rituals associated with the buffalo they rear). In pastoralist cultures, animals are regarded as co-creatures and there is a spiritual

* with additional inputs from Dr. Ilse Kohler Rollefson and members of the Indian Pastoralists Network

relationship with them that is a far cry from the western concept of regarding animals merely as a means of production.

India's indigenous pastoral communities, such as the *Raika and Gujjar* in Rajasthan, the *Maldhari* in Gujarat, the *Gaddi* in Himachal, the *Van Gujjar* in Uttaranchal and the *Konar* of Tamil Nadu, are guardians of native animal breeds (camels; *Kankrej, Gir, Nari, Malaimadu* and *Pulikkulam* cattle; *Neeli Ravi* and *Toda* buffalo; *Kachakatti black sheep* etc.). Over generations, they have nurtured these breeds that can cope with difficult environmental conditions, are resistant to disease and can retain reproductive vigour – traits that are no longer present in high performance or exotic breeds. These communities use indigenous knowledge for animal breeding and have adopted a seasonal and spatial grazing system that is holistic, complementary to forest ecology and symbiotic with agro-ecosystems. They help farmers by supplying organic manure (through penning) and plough bullocks and by providing local transportation for agricultural produce. Their animals control the excess growth of grasses, which prevents the spread of forest fires. Gradually, evidence is also accumulating that pastoral livestock are linked to the conservation of wild animal species. Often there is a long history of coevolution between wild species and livestock, and the eviction of livestock from wildlife reserves may lead to an exodus of predator species or result in changes to the habitat and make it unattractive for wildlife.

Is domestic biodiversity incompatible with wildlife conservation?

Once again, the breeds stewarded by pastoralists represent biological diversity just as the tiger does. But this domestic biodiversity is seen as an enemy of or antagonistic to wildlife conservation by many environmentalists, although the animals kept by pastoralists retain many of the characteristics of their wild progenitors. Ecological research in the Sahara on the effects of camels feeding on desert vegetation demonstrated that grazing by this species actually stimulates plant growth. In the US, there is recognition that predator species such as the wolf depend on livestock as prey and there is a move to compensate pastoralists for the livestock they lose.

The survival of pastoralism is crucial to sustainable land use. Besides conserving domestic biodiversity, it is a means of producing food in dry lands without depleting ground water resources – which is may be the most important aspect to consider in a state such as Rajasthan. A report by the Food and Agriculture Organization (FAO), a UN agency, entitled "Pastoralism in the new millennium" concludes that the politically popular development of range lands by mining fossil water is not a long-term development strategy and that this land may eventually be reclaimed by pastoralists.

Reduction in population of native animal breeds

According to the FAO, one-third of the world's livestock breeds are endangered. A search is underway for legal frameworks that can create an appropriate context for the sustainable use of animal genetic resources. Livestock breeds are linked to cultural diversity, and there is often a link between ethnic or social groups and specific breeds.

For livestock (unlike plants), only *in situ* conservation (in the original production context) achieves all conservation goals. There is a consensus that *ex situ* conservation should only be used as a back-up.

In India, one of the main reasons for the reduction in animal breeds is because forests are being closed owing to their declaration as wildlife sanctuaries or national parks or owing to the implementation of the Joint Forest Management (JFM) programme. Together with the conversion of common property resources for other developmental purposes, this puts pressure on pastoralists and jeopardizes their traditional life style. As pastoralists are unable to sustain their animals without access to common property resources, they are forced to dispose of them in slaughterhouses. Thousands of female camels are sold for slaughter each year, and one of the reasons for this is the grazing problems created after the declaration of Kumbhalgarh Sanctuary in Rajasthan. In Tamil Nadu, *Malaimadu/Pulikkulam* cattle owners are disposing of thousands of cattle every year because of harassment of livestock keepers owing to the implementation of the JFM programme adjoining Srivilliputhur Squirrel Sanctuary. In Virudhunagar district of Tamil Nadu, to sustain his traditional profession, an individual traditional cattle herder has to spend a minimum of Rs.5000 to 10,000 annually on paying penalties, bribes, or for being detained in custody or because of court cases brought against him by the Forest Department. Such harassment discourages herders from their customary life style, and they end up as unskilled labourers or wage earners or migrants in cities.

The following points highlight the alarming scale of reduction of native animal breeds and species:

- The population of *Malaimadu* cattle (undocumented breed) has come down to 55,000 from the original population of 3,00,000 between 1989 and 2004 because of the declaration of Srivilliputhur Squirrel Sanctuary and because of the Tamil Nadu Afforestation Programme (TAP)/JFM.
- The population of camels in Rajasthan reduced by 25% between 1997 and 2003, according to government figures, although a survey conducted by an NGO suggests an even more drastic decline. The declaration of Kumbhalgarh Sanctuary in Rajasthan, which represented a traditional summer grazing ground, is a major causal factor for this decline.
- The population of *Pulikkulam* cattle has diminished to 40,000 because of the declaration of Srivilliputhur Squirrel Sanctuary and because of TAP/JFM.
- The population of *Neeli Ravi* buffalo has drastically diminished to 11,000 because of the forceful evacuation of the *Van Gujjars* (buffalo pastoralists) from the proposed Rajaji National Park in Uttaranchal.
- The population of *Toda* buffalo has declined to 1,500 because of the Mukurti National Park in Ooty and because the Forest Department has encroached on 30,000 ha of the original grazing lands to promote a eucalyptus plantation there.
- The population of *Kachakatti* black sheep has come down from many thousands to 1400. Since 1998, the Forest Department under TAP/JFM has undertaken a tree plantation programme in Vaguthumalai forest in Madurai district. Many herders disposed of their sheep owing to denial of grazing permits in the forest.

- The population of *Umbalachery* cattle has reduced considerably because of encroachment onto revenue grazing land and animal drinking water ponds in coastal wetland tracts in the Nagapattinam and Thanjavur districts of Tamil Nadu.

Problems faced by the pastoral communities

The problems faced by indigenous pastoral communities/herders are summarized below:

- Grazing permits are denied in traditional grazing sites that have been converted into protected areas/wildlife sanctuaries/national parks/JFM programme areas.
- Original pasture lands or stipulated animal drinking water ponds are encroached upon or used for other purposes. Biodiesel (Jatropha) planting is being promoted by state agencies without any thought to the consequences. Migration routes of animals are blocked or herd-passing pathways are encroached upon.
- Pastoralists are being excluded from forestry programs such as JFM and Biodiversity Conservation. Long-standing customary rights or *zamindari* given grazing tenures are ignored in the desire to green areas or to introduce wilderness concepts borrowed from the west without taking into consideration India's rich spiritual knowledge and cultural traditions, which encompass all forms of life and accommodate a holistic conservation of biodiversity. Forests are closed completely for tree planting, and rotational grazing systems are not adhered to for providing alternative grazing sites through participatory processes. Once forests are closed for planting, they are not reopened for animal grazing even after the stipulated period of five to seven years has passed.
- Bribery is common at the field level to allow animals to enter protected areas for grazing purposes. Those who do not bribe lower level forest officials are harassed and have penalties imposed upon them: false cases are booked against pastoral communities by implicating them in hunting incidents, in cases of setting fire to the forests and manhandling officials etc. leading to court cases and related agonies.

Because of these factors, pastoral communities are unable to continue their life style, leading to a reduction in domestic animal breeds and the loss of the indigenous knowledge that sustained them. Under such circumstances, pastoralists are forced to sell cattle and camels to slaughterhouses. This matter has been brought to the notice of the government at state and central levels, but there has been no genuine enquiry on this issue.

Legal frameworks for pastoral rights

Pastoralists are conservers of domestic animal biodiversity, and their way of life contributes to the ecology and economy of the nation. There is a strong need to recognize their role in conservation. Instead of marginalizing pastoralists and stigmatizing them as destroyers of forests, they should be integrated into forest management programmes in a holistic manner and their knowledge in natural resource management should be made use of. India is obliged to do this in the context of both national legislation as well as the international agreements that it has signed.

The **Biological Diversity Act. 2002** stipulates that conservation, sustainable use of biological diversity including ***in situ*** **conservation** of breeds of domestic animals under their surrounding natural habitat (Section 36 & 41) where the breed has been evolved or maintained by communities. This calls for recognizing the role of pastoralists or indigenous livestock keeping communities who conserve native breeds by using indigenous knowledge in livestock breeding.

As a signatory to the United Nations Convention on Biological Diversity, India has committed itself *to respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity.*

India also recognizes the Right To Food in the context of national food security and therefore should adhere to the voluntary guideline 8d: Genetic Resources for Food and Agriculture that stipulates that, "States, taking into account the importance of biodiversity and consistent with their obligations under relevant international agreements should consider specific national policies, legal instruments and supporting mechanisms to prevent the erosion of and ensure the conservation and sustainable use of genetic resources for food and agriculture including, as appropriate, for the protection of relevant traditional knowledge and equitable participation in sharing benefits arising from the use of these resources, and by encouraging, as appropriate the participation of local and indigenous communities and farmers in making national decisions on matters related to the conservation and sustainable use of genetic resources for food and agriculture."

As a member of The Durban Action Plan (2004), which was the outcome of the Vth IUCN World Parks Congress (September 2003), India has the mandate of *securing the rights of indigenous peoples, including mobile indigenous peoples, and local communities in relation to natural resources and biodiversity conservation***.**

The Draft Scheduled Tribes (Recognition of Forest Rights) Bill, 2005 (still awaiting approval of Parliament) envisages rights of uses or entitlements such as grazing in forests and traditional seasonal resource access of nomadic or pastoralist communities (both settled and transhumant).

Therefore, the Government of India is obliged to seriously consider recognizing and protecting the role of pastoralists/herders and for conferring the following rights that will support both livelihoods and community conservation of domestic animal biodiversity:

1. To restore traditional grazing rights and camping rights in forest areas including wildlife sanctuaries and national parks and also in those areas earmarked for grazing purposes in village common lands.
2. Formalizing entitlements (including issue of permanent grazing cards) for the traditional pastoralists/herders who maintain native animal breeds and who depend upon them for their livelihood to allow them free access to notified or demarcated grazing sites and migration routes.
3. Whenever a tree planting programme is to be implemented, alternative grazing lands and drinking water resources for animals should be allotted by the concerned authorities. It should be made mandatory for the implementing agency before initiating afforestation programmes to seek prior consent from forest dependant communities including pastoralists. A rotational system of grazing should be encouraged instead of completely closing the forest zone for tree

plantation purposes, and the process should be facilitated by participatory discussion with livestock keeping communities.

4. In-depth documentation, characterization of indigenous livestock breeds should be carried out to recognize and protect the intellectual property rights of the local communities/individuals conserving these local livestock breeds.
5. Pastoralists should be involved in all local natural resource management programmes including village forest committees and community conservation approaches to address the fodder and drinking water requirements of their livestock.
6. Encroached land or unutilized common lands assigned to forest departments should be retrieved and brought under the control of village level committees to allow grassroots institutions to develop pasture land.

Reference source

Publications and Survey Reports with SEVA.

Testing of Traditional Methods of Weather Forecasting in Gujarat Using the Participatory Approach

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Abstract

Saurashtra, located in the western part of the state of Gujarat, is predominantly a dry land farming area. Since the early seventies, it has been identified as a drought prone area. The farmers of this region place a lot of importance on the prediction of the onset of the monsoon since the choice of cropping pattern depends on it. Early showers would enable a farmer to go in for long duration crops such as groundnut (spreading type) and cotton.

Considerable progress has been made by Indian satellite technology. However, the predictions made by the India Meteorological Department do not help farmers very much when they have to make choices related to cropping patterns because the Department only makes long-range predictions for the nation as a whole. In the case of specific regions, the predictions are short range in nature, i.e., for a period of three days only. As a result, farmers in the dry land regions of India rely mainly on indigenous meteorological beliefs and knowledge to make predictions regarding the monsoon. The farmers' traditional meteorological beliefs are quite strong. Traditional meteorologists use methods and principles evolved by eminent astronomers and astrologers such as Varahmihir (700–800 AD), Bhadri (1000–1200 AD), Poet Ghagh (1200–1300 AD) and Unnad Joshi (1350–1400 AD). Many of the principles were contained in cultural and religious books or passed on from generation to generation by word of mouth. In this paper, we present our experience of participatory meteorological assessment and prediction with the farmers of Saurashtra, on the basis of the traditional beliefs and principles of the region. The process initiated in 1990 has taken the form of an informal network of local experts and formal scientists that provides voluntary service to the people of Saurashtra by making predictions on the basis of collective assessment.

Biological indicators of the monsoon have also been well documented and are extensively used by local experts. Pisharoty (1993) reported that the tree Amaltas or golden shower (Cassia fistula) is a unique indicator of rain. It bears bunches of golden yellow flowers in abundance about 45 days before the onset of the monsoon. This is also mentioned in "Brahad Samhita" written by Varahmihar (circa 8th century). The results will be discussed. We documented various tree species that have been used as indicators of the monsoon by local communities.

Observations on the behaviour of specific birds and animals have also been used as indicators of rain. As many as 500 ancient beliefs were documented from the text as well as from the experiences of old people. To overcome time and resource constraints, eight beliefs were short-listed on the basis of their popularity in the region. These have also been recorded by academics in Gujarati, the vernacular language.

Apart from validating these beliefs across the whole of the Saurashtra, the study has helped to restore the confidence of the people in their traditional knowledge and skill. The resulting knowledge network has brought together the expertise of the region, cutting across formal and informal systems. Such a network helps individual experts pool their knowledge and learn from each other. It enables

the group as a whole to make a collective judgement and to provide the farming community with a valuable service that helps farmers make decisions.

Our group has already acquired a high degree of credibility because of the successful predictions it has made over the past 11 years. In 1993, we got more than 500 observations on wind directions on Akshya Tritya and Holi. As a result, we were able to make very accurate predictions. We even predicted the likelihood of a locust attack. This prediction came true and added to our credibility.

It is this service and the resulting support and appreciation of the farming community that keeps the network going. The network emerged spontaneously and has experienced an organic growth. It exists because of the need that it helps meet. The experimentation and prediction are likely to continue without the help of external support. In the process, valuable meteorological data will be generated and additional beliefs will be tested. We believe that such a network can serve as a model for farmers of other dry land areas who rely on traditional experts for predictions of the monsoon.

Introduction

Saurashtra, located in the western part of the state of Gujarat, is predominantly a dry land farming area. Since the early seventies, it has been identified as a drought prone area. The occurrence of drought has become a regular phenomenon of the region and other adjacent parts of the state. The monsoon (from June to September) is characterized by irregular, erratic and uneven showers.

The farmers of this region place a lot of importance on the prediction of the onset of the monsoon since the choice of cropping pattern depends on it. Early showers would enable a farmer to go in for long duration crops such as groundnut (spreading type), cotton and sesamum. On the other hand, a delayed monsoon would mean restricting the choice to pulses, pearl millet, castor and the bunch type of groundnut.

Although Indian satellite technology has made considerable progress since independence, the monsoon predictions made by the India Meteorological Department are not very helpful to farmers in making choices related to cropping patterns. This is because the Department only makes long-range predictions for the nation as a whole. In the case of specific regions, the predictions are short range in nature, i.e., for a period of three days only. As a result, farmers in Saurashtra (as in many other dry land regions of India) rely mainly on indigenous meteorological beliefs and knowledge to make predictions regarding the monsoon. They base their crop-mix decisions on the predictions made by local experts.

The farmers' beliefs in traditional meteorological beliefs are quite strong. The local experts use methods and principles evolved by eminent astronomers and astrologers such as Varahmihir (700–800 AD), Poet Ghagh (1200–1300 AD), Unnad Joshi (1350–1400 AD) and Bhadli (1000–1200 AD). Many of the principles were contained in cultural and religious books or passed on from generation to generation by word of mouth.

The Junagadh Campus of Gujarat Agricultural University (GAU) is located in the heart of the Saurashtra region. The University has been contributing to the development of agriculture in the region since 1960. In this paper, we present our experience of participatory meteorological assessment and prediction with the farmers of Saurashtra on the basis of the traditional beliefs and principles of the region. The process initiated in 1990 has taken the form of an informal network of local experts

and formal scientists that provides voluntary service to the people of Saurashtra by making predictions on the basis of collective assessment.

1. Structure of the paper

Methodology

The paper is divided into four sections. After providing a brief review of the traditional meteorological knowledge and principles of the area, the beliefs that were chosen for validation and systematic assessment are described. Then, the details of the process by which local experts got involved in the systematic scaling up and refinement of their techniques are given and, finally, the conclusion is presented.

Traditional principles: A brief review of the literature

Bhadli (circa 12th century) described ten "chieftains" (variables) responsible for the development of the "ethereal embryo" of rain. These are wind, clouds, lightning, colours of the sky, rumbling, thunder, dew, snow, rainbow and occurrence of an orb around the moon and the sun. Bhadli considered the interactions of these variables with interplanetary, stellar systems during each of the 12 lunar months to characterize rainfall patterns through out the year (names and dates of constellations are given in Appendix 1).

Raman (1960) identified general atmospheric situations as indicators of a healthy conception of the "ethereal embryo" – that which leads subsequently to rain. Some of these are listed below:

1. Gentle and agreeable wind from the north, north-east and east
2. Clear sky
3. Soft, white deep halo around the moon or the sun
4. Dark-coloured sky – as dark as a crow's egg
5. Sky overcast with huge, bright dense clouds
6. Needle-shaped or sword-shaped clouds
7. Blood-red clouds
8. Rainbow in the morning or in the evening
9. Low rumblings of thunder
10. Lightning
11. Appearance of a "mock sun"
12. Planets and stars shining in full form and with soft light

Similarly, Golakia (1992) collected local beliefs regarding the occurrence of drought on the basis of meteorological observations:

1. If the sky acquires a faint yellow colour, there is less hope of rain.
2. If crow-coloured clouds are observed throughout the day while the night sky remains clear, a drought is indicated.
3. If the velocity of wind is not high during the *Mrighirsh* constellation and high heat is not experienced during the *Rohini* constellation, a drought can be expected to follow.
4. If it does not rain in *Adra* and no winds occur in *Mrighirsh*, then a drought will occur.

5. If the wind blows from the east during the month of *Shrawan* and from the south-west during the month of *Bhadrapad*, a severe drought can be expected.
6. Occurrence of wind with velocity on the fifth day of the first fortnight of the month of *Shrawan* is indicative of severe drought.
7. Occurrence of rain in the presence of sunshine is an indicator of poor rainfall in the near future.

Biological indicators of the monsoon have also been well documented and are extensively used by local experts.

Kanani *et al.* (1995) documented various tree species that have been used as indicators of the monsoon by local communities (see Table 1).

Table 1. Flowering and foliage of tree species as indicators of rain

Name of Species	Indicator	Expected outcome
Mahuda, *Madhuca latifolia*	Good foliage	Good monsoon
Bamboo species	Good foliage	Drought, rat attack
Ber, *Zyzyphus mauritiana*	Heavy flush of fruit	Average monsoon
Darbha grass *Eragrostis cynosuroides*	Appearance of good foliage	Good monsoon
Billi, *Aegle marmelos*	Good foliage	Subnormal monsoon
Pipal, *Ficus religiosa*	Good foliage	Adequate rain
Khejro, *Prosopis cineraria*	Heavy foliage	Drought
Kothi, *Limonia acidissima*	Good growth	Stormy rain
Neem, *Azadirachta indica*	Heavy flush	Drought

Observations on the behaviour of specific birds and animals have also been used as indicators of rain, as reported by Savalia *et al.* (1991) and Golakia (1992) (see Table 2).

Table 2. Behaviour of birds and animals as predictors of rain

Indicator	Expected outcome
Sparrow bathing in dust	Good rain
Kachinda (chameleon) climbs the tree and assumes black-white-red colours	Immediate rain
Frogs start singing in the initial days of *Jayestha* (May)	Early rain
Batairs (a bird) sing in pairs	Certainty of rain
Peacocks cry frequently	Rain within a day or two
Crows cry during the night and foxes during the day	Severe drought

Titodi or lapwing bird lays eggs during the night, especially on river banks	Heavy rains
Klheu/Bapaiya (a bird) sings songs early in the morning	Rains within a day or two
Snake climbs up on trees	Drought
Camel keeps facing the north-east direction, goat does not browse, crow scratches its nest	Immediate rains
Birds take bath in the dust on the full moon day of *Jayestha* (May)	Plenty of rain

Pisharoty (1993) reported that the tree *Amaltas* or golden shower tree (*Cassia fistula*) is a unique indicator of rain. It bears bunches of golden yellow flowers in abundance about 45 days before the onset of the monsoon. This is also mentioned in *Brahad Samhita* written by Varahmihar (circa 8th century). The results of an observation of this tree as an indicator of the monsoon are given below (see Tables 3 and 4).

Table 3. Details of observation/prediction of monsoon on the basis of the flowering of the *Amaltas* or golden shower tree (*Cassia fistula*)

S. No.	Assessment year	Date of flowering in *Amaltas*	Date 45 days after flowering (as per text) (1)	Actual date of onset of the monsoon (2)	Difference between (1) and (2)
1	1996	29th April	13th June	14th June	+1
2	1997	20th April	4th June	1st June	-3
3	1998	22nd April	6th June	9th June	+3
4.	1999	30th April	14th June	17th June	+3
5	2000	26th April	10th June	8th June	-2
6	2001	29th April	13th June	14th June	+1
7	2002	23rd April	7th June	16th June	+9
8	2003	25th April	9th June	16th June	+7

Table 4. The details showing the observed and expected frequencies of the golden shower tree

Class	Observed frequencies	Expected frequencies	Proportion observed	Proportion expected
1	46	45	.7188	.7031
2	42	45	.6563	. 7031
3	48	45	7500	.7031
4	48	45	.7500	.7031
5	43	45	.6719	.7031
6	46	45	.7188	.7031
7	54	45	.8438	.7031
8	52	45	.8125	.7031
Total	379	360	5.9219	5.6250

Chi-Square = 3.622   Probability = .7276

The χ^2 value was found to be non-significant. This indicated that there was no real difference between the expected and observed frequencies. This means that since 1996, the year this study was undertaken, whatever dates the monsoon was expected on, on the basis of the flowering of the Amaltas (*Casia fistula*), were in agreement with the actual onset of the monsoon.

Participatory validation, assessment and prediction

Trigger

In 1990, the Meteorological Department had predicted normal monsoons for the nation as a whole. Although the monsoon was normal in the rest of the country, it eluded the region of Saurashtra till the month of July. The farmers of the region were anxious, since the time for sowing the long duration crops had already passed by. It was during this time that I had the occasion to meet two local meteorological experts.

The first was Devji bhai Jamod, of Jetalsar village, an engine driver employed with the Indian Railways. He was deeply interested in rainfall predictions as a hobby and used to record meteorological observations in his diary on a daily basis. Devji bhai was emphatic that there was no possibility of monsoon that year till the 15th of August. His assertion was based on the traditional belief that

"If there is a rain, accompanied with lightning and "roaring of clouds" (mild thunder), on the second day of *Jayestha*, there will be no rain for the next seventy-two days" (Bhadli, circa 12th century).

Jadhavbhai Kathiria of Alidhra village, a farmer and school teacher, made precisely the same prediction on the basis of the same observation.

We were intrigued by their observations and predictions and were curious to see the efficacy of this knowledge. To our surprise, their predictions came true. Exactly

after 72 days, on 15th August, Saurashtra experienced heavy showers, enabling farmers to plant late season crops.

So impressed were we by the successful predictions of these local experts that we decided to publicize the details in the local press. Their success was reported by almost all the local dailies such as *Phoolchhab, Sandesh, Gujarat Samachar* and *Akila*. An appeal was also made to readers to send information on other such local meteorological experts in Saurashtra. Many farmers wrote back suggesting that the University should take up systematic research on the topic. This was the genesis of the project on systematic validation of traditional meteorological beliefs and principles.

2. Belief chosen for validation

In 1990, we initiated a research project at the Department of Extension, Junagadh Campus, to take up selected meteorological beliefs for scientific validation. The following beliefs were short-listed on the basis of their popularity in the region. These have also been recorded by academicians in Gujarati, the vernacular language (Trivedi, 1986; Adhvaryu, 1974).

1. If there is rain at the beginning of the *Rohini* constellation with lightning accompanied by "roaring of clouds" (light thunder), there will be no rain for the next 72 days.
2. If there is rain during the *Adra* constellation, there will be rain during the next three constellations, viz., *Punarvasu, Pushya* and *Ashlesh.*
3. If there is rain during the *Punarvashu* constellation, there will definitely be rain during the *Pushya* constellation.
4. If rain occurs on second and fifth day of the first fortnight of *Ashadh*, there will definitely be more rain in the second fortnight of *Ashadh* and in the first fortnight of *Shravan,* respectively.
5. If the 11th day of the month of *Ashadh* (known as *Dev Podhi Ekadashi*) falls on a Sunday, Saturday or Tuesday, then food grains will be costly and there will be "rainy hazards" (losses on account of thunder storms and natural calamities).
6. If on the 12th day of the month of *Kartika*, the sky is clear at night with a bright moon (known as *Pushpa bandh yog*), the ethereal embryo will develop in the forthcoming monsoon.
7. Observations of the wind direction on *Holi*, in a period starting about half an hour before the lighting of the *Holika* to about half an hour after it has been lit, can be used to forecast the rainfall for the year (see Figure 1 for the various wind directions and associated outcomes).
8. Observations of the wind direction on *Akshya Tritiya* from 3 am to 6 am can be used to predict the rainfall pattern and expected crop yield for the year (see Figure 2 for the various wind directions and associated outcomes).

HOLI PREDICTION

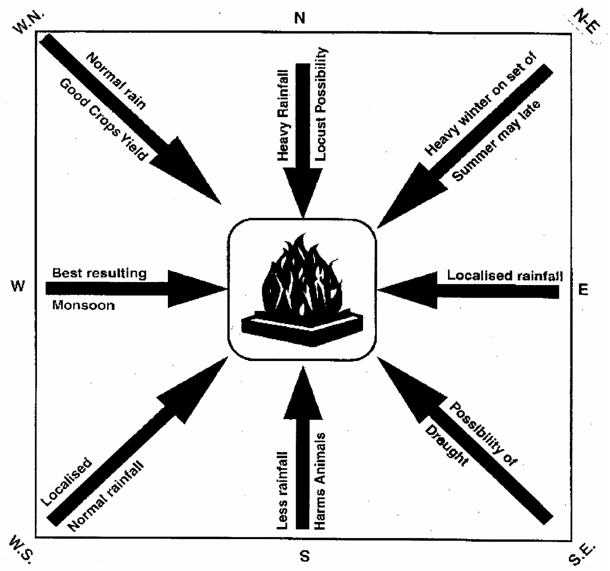


Fig. 1 Prediction of rainfall / Year through direction direction of wind on the day *Holi* Observation time : Before and after half an hour at the time of enlighting the *Holi*

AKSHAY TRITYA PREDICTION

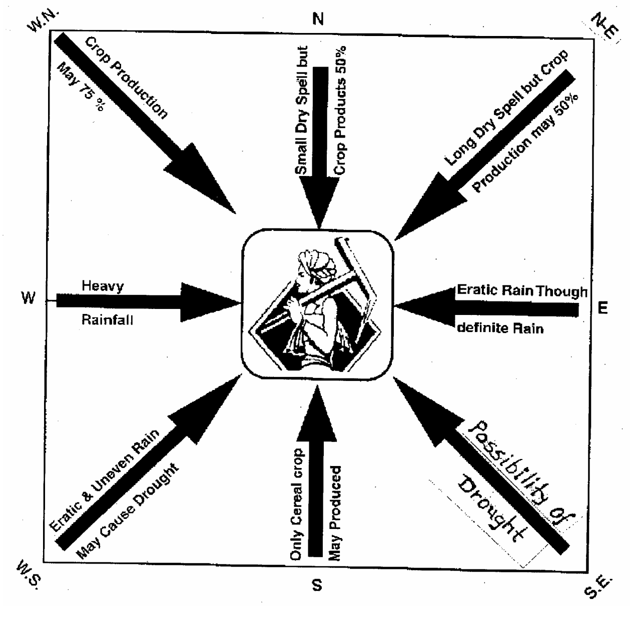


Fig. 2 Prediction of rainfall / Year through direction of wind on the day *Akshaya Tritya* (observation time : 3.00 – 6.00 a.m)

The last two of these beliefs are based on Bhadli's couplets and are perceived as the most reliable indicators by a majority of the local experts. These beliefs are based on the direction of the wind on two specific days, viz., *Akshya Tritya* and the day of the *Holi* festival. Predictions could be made not only about the ethereal embryo of the monsoon but also on secondary outcomes such as intensity of diseases and pests and expected crop yields.

Emergence of knowledge network

To enable farmers record the observations on the last two beliefs, we developed diagrams (Figures 1 and 2) providing instructions on how to make systematic observations of the direction of the wind. These diagrams were developed after extensive consultation with local experts. In 1992, these were published, for the first time, in the local dailies with an appeal to farmers and local experts to send their observations to the GAU. The editors of all the local dailies decided to publish these diagrams free of charge. They felt it was an important experiment for the region and were only too happy to provide this service to the farming community, which constituted its main readership. They continued to provide this support in subsequent years, in the same spirit, and have published the charts every year.

In response to the initial appeal in 1992, we received more than 200 letters from farmers all over Saurashtra. The responses were classified according to the districts and talukas from which they came. We needed collaborators from the entire region, and this classification would help us in selecting potential collaborators. Two hundred collaborators were selected from the six districts of Saurashtra as follows: Junagadh (61), Amreli (45), Rajkot (37), Jamnagar (32), Bhavnagar (17) and Surendranagar (8).

3. The participative research and the prediction process

The collaborators were sent a questionnaire in which they were expected to record observations on various parameters such as velocity and direction of wind, humidity, occurrence of a rainbow, occurrence of an orb around the moon and sun, occurrence of dew etc. These observations were to be made for 195 days from the 1st day of *Kartika* to the 15th day of *Chaitra*. Collaborators were also expected to make observations on fixed days (for beliefs 7 and 8) as advised through the local press. The observations recorded by the participating experts were tabulated each year and analyzed on the basis of criteria given by Bhadli.

On June 16, 1997, the first seminar on Ancient Methods for Studying Rain Phenomena was organized at Junagadh in which about 60 traditional meteorologists participated. The GAU sponsored the seminar, and each local expert was allowed to present his/her findings and make predictions. The predictions were documented in the proceedings and carried to the people by the local press.

The seminar was a great success and resulted in the formation of an Ancient Rain Prediction Network. The seminar became an annual feature. The participation from local experts has been increasing each year. Participants come from all over Saurashtra at their own cost. Only network members are invited to present their predictions for the forthcoming monsoon. In subsequent years, local experts get a

chance to review their previous predictions and make suitable improvements in their techniques. Their peers hold experts who have made accurate predictions over the years in high esteem.

In terms of gender, the participation of women was weak with only four women participating in the seminar. These women came from nearby villages. They had earlier attended a training programme at the Farmers' Training Centre, run by the GAU. When they came to know about the seminar, they decided to attend.

However, the low participation by women does not mean that women are less interested in the subject. One of the women participants brought to the seminar a Gujarati publication on Bhadli's *Vakya* and made it accessible to other members of the network.

In the seminar held on the 6th July 1999, a resolution was passed to establish a professional body called the "Ancient Rain Phenomena Association". The names of the executives of this association are given in Appendix 2. The procedure to get the Association registered has been initiated. An executive body with members representing different parts of Saurashtra has been established. The rules and norms are now being evolved. The annual membership fee is Rs.75, while the life membership fee has been fixed at Rs.525.

4. Validation of traditional meteorological beliefs in Saurashtra: Summary of findings

Testing of the eight beliefs (treated as hypotheses) has been carried out since 1990. Each year the results were presented to the Agricultural Research Committee at the GAU, in order to get feedback from researchers and extension workers.

The observations taken over a period of 14 years, from 1990 to 2003, indicated that seven out of the eight hypotheses have not been proved untrue so far (see Tables 5.1 to 5.9). The results indicate that many of these beliefs are likely to be reliable indicators of the monsoon.

Table 5.1. Hypothesis: If there is rain at the beginning of the *Rohini* constellation with lightning accompanied with "roaring of clouds" (light thunder), there will be no rain for the next 72 days

Inference: The belief has proven to be true since 1990.

Year	Occurrence of condition specified	Rainfall
1990	Condition observed on 25/5/90	Rainfall recorded exactly after 72 days, i.e., on 16th August 1990
1991	Condition specified did not occur	Monsoon was regular
1992	Condition specified did not occur	Monsoon was regular
1993	Condition specified did not occur	Monsoon was regular
1994	Condition specified did not occur	Rain was recorded during 72 day period

1995	Condition specified did not occur	356 mm rainfall recorded during 72 day period
1996	Condition specified did not occur	642 mm rainfall recorded during 72 day period
1997	Condition specified did not occur	514 mm rainfall recorded during 72 day period
1998	Condition specified did not occur	681 mm rainfall recorded during 72 day period
1999	Condition specified did not occur	312.4 mm rainfall recorded during 72 day period
2000	Condition specified did not occur	341.8 mm rainfall recorded during 72 day period
2001	Condition specified did not occur	529.7 mm rainfall recorded during 72 day period
2002	Condition specified did not occur	537 mm rainfall was recorded in 23 rainy days
2003	Condition specified did not occur	1280 mm rainfall was recorded in 43 rainy days

Table 5.2. Hypothesis: If there is rain during the *Adra* constellation, there will be rain during the next three constellations, viz., *Punarvasu, Pushya* and *Ashlesha*

Inference: This was found to be false in 1995, and hence, it can be considered a reliable indicator of rain.

Year	Occurrence of condition specified	Rainfall (in mm)
1990	35.5 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 30.2, *Pushya* – 18.4, *Ashlesha* – 21.3
1991	13 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 241.05, *Pushya* –148, *Ashlesha* – 43.08
1992	35.6 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 15.4, *Pushya* –351.6, *Ashlesha* – 103.7
1993	34.4 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 95.8, *Pushya* – 2.8, *Ashlesha* – 10.9
1994	258 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 434, *Pushya* – 117, *Ashlesha* – 55
1995	No rains observed during the *Adra* constellation	*Punarvasu* – 361.9, *Pushya* –258.7, *Ashlesha* – 22.1
1996	18 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 33.2, *Pushya* –285.3, *Ashlesha* – 30.7
1997	152.8 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 117.9, *Pushya* –163.4, *Ashlesha* – 23.9

1998	362.9 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 83.4, *Pushya* –93.2, *Ashlesha* – 94
1999	67.3 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 200.2,*Pushya* –18.48, *Ashlesha* – 21.5
2000	156.3 mm rainfall recorded during *Adra* constellation	*Punarvasu* –152.6, *Pushya* –0.6, *Ashlesha* – 94.3
2001	30.6 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 114.3, *Pushya* – 84.2, *Ashlesha* – 153.4
2002	277.2 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 12.9, *Pushya* –32.9, *Ashlesha* – 24.1
2003	58 mm rainfall recorded during the *Adra* constellation	*Punarvasu* – 422.3, *Pushya* – 78.3, *Ashlesha* – 396.4

Table 5.3. Hypothesis: If there is rain during the *Punarvasu* constellation, there will definitely be rain during the *Pushyai* constellation

Inference: This belief has been found to be true every year since 1990, except in 2000.

Year	Occurrence of condition specified	Rainfall (in mm)
1991	*Punarvasu* – 30.28	*Pushya* – 18.42
1992	*Punarvasu* – 241.05	*Pushya* – 148
1993	*Punarvasu* – 95.8	*Pushya* – 2.8
1994	*Punarvasu* – 434	*Pushya* – 117
1995	*Punarvasu* – 361.9	*Pushya* – 258.7
1996	*Punarvasu* – 33.2	*Pushya* – 285.3
1997	*Punarvasu* – 117.9	*Pushya* – 163.4
1998	*Punarvasu* – 83.4	*Pushya* – 93.2
1999	*Punarvasu* 200.2	*Pushya* 18.48
2000	*Punarvasu* 152.6	*Pushya* 0.6
2001	*Punarvasu* 114.3	*Pushya* 84.2
2002	*Punarvasu* 12.9	*Pushya* 32.9
2003	*Punarvasu* 58	*Pushya* 422.3

Table 5.4. Hypothesis: If rain occurs on the second and fifth day of the month of *Ashad*, there will definitely be more rain during the second fortnight of *Ashadh* and the first fortnight of the month of *Shravan*, respectively.

Inference: Except for 1995 and 2001, the hypothesis was found to hold.

Year	Occurrence of condition specified	Rainfall (in mm)
1990	Rainfall observed as follows: 2nd day of *Ashadh* – 5 mm 5th day of *Ashadh* – 22.34 mm	2nd fortnight of *Ashadh* – 37.5 1st fortnight of *Shravan* – 59.7
1991	2nd day – 118 mm 5th day – 53.7 mm	2nd fortnight of *Ashadh* – 117 1st fortnight of *Shravan* –50.2
1992	2nd day – 10 mm 5th day – 6 mm	2nd fortnight of *Ashadh* – 246.5 1st fortnight of *Shravan* –219.4
1993	2nd day – 25 mm 5th day – No rain	2nd fortnight of *Ashadh* – 127 1st fortnight of *Shravan* –1
1994	2nd day – 21 mm 5th day – 80 mm	2nd fortnight of *Ashadh* – 45 1st fortnight of *Shravan* – 60
1995	2nd day – 10 mm 5th day – no rain	2nd fortnight of *Ashadh* – 443.7 1st fortnight of *Shravan* – 155
1996	2nd day – 1.9 mm 5th day – 1.2 mm	2nd fortnight of *Ashadh* – 36 1st fortnight of *Shravan* – 39.9
1997	2nd day – 6.3 mm 5th day – 0.2 mm	2nd fortnight of *Ashadh* – 164.1 1st fortnight of *Shravan* – 25.9
1998	2nd day – 20.80 mm 5th day – 63.8 mm	2nd fortnight of *Ashadh* – 117.4 1st fortnight of *Shravan* –139.4
1999	2nd day 100.5 mm 5th day 0 mm	2nd fortnight of *Ashadh* – 21.3 1st fortnight of *Shravan* –4.80
2000	2nd day 13 mm 5th day 97 mm	2nd fortnight of *Ashadh* – 1.1 1st fortnight of *Shravan* –85.7
2001	2nd day 0 mm 5th day 0 mm	2nd fortnight of *Ashadh* – 141.7 mm 1st fortnight of *Shravan* –56.8 mm

Table 5.5. Hypothesis: If the 11th day of the first fortnight of *Ashadh* (*Dev Podhi Ekadashi* – DPE) falls on a Sunday, Saturday or Tuesday, natural hazards due to excess rainfall may occur, causing food grain prices to shoot up

Inference: This hypothesis was found to be true, except in 1995, when it was found to be only partially true.

Year	Occurrence of condition specified	Rainfall pattern and natural calamities
1990	DPE was on a Tuesday (3/7/90)	Heavy rainfall recorded in Kutch and Banaskantha, resulting in floods. Food grain prices were unusually high.
1991	DPE was on a Thursday(22/7/91)	No natural calamities
1992	DPE was on a Friday (10/7/92)	No natural calamities
1993	DPE was on a Wednesday (30/7/93)	No natural calamities
1994	DPE was on a Tuesday (11/7/94)	Heavy rainfall was recorded all over Gujarat. The plague occurred in South Gujarat. Food grain price were high
1995	DPE was on a Sunday (9/7/95)	No natural calamities; however, food grains prices were observed to be high.
1996	DPE was on a Saturday (27/7/96)	A cyclone occurred with heavy rain, causing extensive damage to standing crops and trees. Food grain prices were high.
1997	DPE was on a Wednesday (16/7/97)	Heavy rains in North Gujarat; prices of food grain were stable.
1998	DPE was on a Sunday (5/7/98)	Severe cyclone in the coastal area of Saurashtra on June 8, 1998; floods in Surat city due to the heavy rainfall. Prices of food grains, potatoes and onions were very high.
1999	DPE was on a Saturday (24/7/1999)	Localized rain observed and the price of food grains was high.
2000	DPE was on a Wednesday (12/7/2000)	Irregular rain observed, but the price of food grains was stable.
2001	DPE was on a Monday (1/7/2001)	Rainfall was satisfactory
2002	DPE was on a Thursday (10/7/2002)	Rainfall was satisfactory
2003	DPE was on a Saturday (20/7/2003)	1280 mm of rainfall was recorded in 43 rainy days; natural hazards occurred

Table 5.6. Hypothesis: If on the 12th day of the month of *Kartika*, the sky is clear at night with a bright moon (known as *Pushpa bandh yog*), it is believed that the ethereal embryo will develop in the forthcoming monsoon

Inference: This belief has proven true since 1990.

Year	Occurrence of condition specified	Rainfall pattern
1990	Clear sky on the specified day	Monsoon was satisfactory
1991	Cloudy sky	Monsoon was erratic and uneven
1992	Very clear sky	Normal monsoon, evenly distributed
1993	Cloudy sky	Erratic rainfall
1994	Clear sky	Regular and adequate monsoon
1995	Cloudy sky	Erratic rainfall
1996	Clear sky	Regular monsoon
1997	Clear sky and bright moon	Regular and adequate monsoon
1998	Clear sky and bright moon	Regular and adequate monsoon
1999	Cloudy sky and dull moon	Monsoon was irregular in nature
2000	Cloudy sky and dull moon	Monsoon was irregular in nature
2001	Very clear sky	Regular monsoon
2002	Cloudy sky and dull monsoon	Rain was irregular and uneven
2003	Clear sky	Monsoon was regular

Table 5.7. Hypothesis: The direction of the wind approximately half an hour before and after the lighting of the *Holika* on the day of the *Holi* festival can be used to forecast rainfall for the year. A set of eight hypotheses has been proposed on the basis of the eight wind directions, as shown in Figure 1

Note: This belief was pre-tested between 1990 and 1993 and gave positive indications. During this time, the diagram shown in Figure 1 was developed to facilitate systematic recording of wind direction by farmers. Since 1994, recording has been made with the help of this diagram.

Inference: This belief has proven to be true since 1993 and was found to be a reliable indicator of rainfall.

Year	Occurrence of Condition Specified	Rainfall pattern
1994	**Holi was observed on 26/3/94** Reported wind direction was north and north-west Normal rainfall was predicted with a strong **possibility of a locust attack**	Normal monsoon. **Locust attack caused** extensive damage to crops.
1995	**Holi was observed on 16/3/95** The wind direction was east to west, indicating localized rainfall	Localized rainfall in South Saurashtra zone

1996	**Holi was observed on 14/3/96** 153 observations were received from farmers; reported wind direction was east to west, indicating localized rainfall	Localized rainfall occurred
1997	**Holi was observed on 24/3/97** 143 observations were received. The wind direction in 52.5% of the cases was reported as being from the north-west and west. Good rainfall was predicted.	Good rainfall occurred
1998	**Holi was observed on 12/3/98** 111 observations were received. In 55.5% of the cases, the wind direction was indicated as being from the north-west and west. Good rainfall was predicted.	Good rainfall occurred
1999	From 1999, no observations could be made.	

Table 5.8: Hypothesis: Observations of the wind direction on *Akshya Tritiya* (third day of the month of *Vaishaka*) from 3 to 6 am can be used to predict the rainfall pattern and expected crop yield for the year. A set of eight hypotheses has been proposed on the basis of the eight wind directions, as shown in Figure 2

Inference: This belief has proven to be true since 1990 and was found to be a reliable indicator of rainfall.

Year	Occurrence of condition specified	Rainfall (in mm)
1994	***Akshya Tritiya* observed on 13/5/94** Responses were received from 504 farmers; 63% indicated the wind as being from the west, while 35% indicated a north-westerly direction for the wind. Heavy rain was predicted with 75% crop yield.	Prediction came true.
1995	***Akshya Tritiya* observed on 3/5/95**. Observations were received from 51 farmers; 40% indicated the wind as being from the west, while 30.5% indicated a north-westerly direction for the wind. Sufficient rain resulting in about 65% yield was predicted.	The prediction came true.
1996	***Akshya Tritiya* observed on 20/5/96.** Responses were received from 386 farmers. The wind direction was as follows: north-west (30%), west (24.5%) and north (13.2%). Sufficient rain with about 65% crop yield was predicted	This was found true.

1997	***Akshya Tritiya* observed on 9/5/97.** Responses were received from 243 farmers. The wind direction was as follows: west (52%), indicating good rainfall for all crops, and south-west (46%), indicating erratic rainfall. Moderate rainfall with 50% crop yield was predicted.	This was found true.
1998	***Akshya Tritiya* observed on 29/5/98.** Responses were received from 288 farmers. Wind direction: west and north-west (79%), indicating good rainfall for all crops, and south-west (13%), indicating erratic rainfall. A 75% crop yield was predicted.	Rains were sufficient in all areas except Northern Saurashtra, which experienced erratic rainfall.
1999	*Akshya Tritiya* observations could not be taken	Rainfall was only 431.3 mm in 30 rainy days
2000	***Akshya Tritiya* observed on 6/5/2000** Responses were received from 567 farmers. Wind direction: west and north-west (51%), indicating good rainfall for all crops, and south-west (33%), indicating drought, erratic rainfall and a 50% crop yield was predicted.	Rain was insufficient (594.80 mm) in 30 rainy days. The whole region experienced erratic and uneven rainfall.
2001	***Akshya Tritiya* observed on 26/4/2001** Responses were received from 418 farmers. Wind direction: west and north-west (71%), indicating good rainfall for all crops, while north-east and south-east (20%), indicating irregular rainfall. A 75% crop yield was predicted.	Rainfall was 848.60 mm in 51 rainy days.
2002	***Akshya Tritiya* observed on 15/5/2002** Responses were received from 122 farmers. Wind direction: west and north-west (70%), indicating good rainfall for all crops, while south-east and south-west (23%), indicating drought. A 60–65% crop yield was predicted.	Rainfall was 537.8mm in 23 rainy days.
2003	***Akshya Tritiya* observed on 4/5/2003** Responses were received from 149 farmers. Wind direction: west and north-west (69%), indicating good rainfall for all crops, while south (6%) and north- east (4%), indicating natural hazards. An 85% crop yield was predicted.	Rainfall was 1280.8 mm in 43 rainy days.

The data collected for the wind direction on *Akshya Tritya* for the years 1994 to 2003 (except for the year 1999) were utilized to obtain a prediction equation for future forecasting and to plan the cropping pattern.

The responses of the respondents recorded from seven districts of the Saurashtra region were recorded. For various variables, viz., X_1, X_2, X_3 and X_4, the cropping yield potential was determined for each year.

An attempt has been made to obtain a prediction for the future cropping potential, Ý. All four variables (X_1 to X_4) were regressed on Ý, and the constants generated are given in equation 1. This equation provided considerable predictability, i.e., 95%.

Table 5.9. Details of dependent and predictor variables

Year	Fore casted crop yield (Ý)	Wind direction observed by the largest no. of respondents (X_1)	% response received for wind direction for X_1 (X_2)	Wind direction observed by the second largest no. of responden ts (X_3)	% response received for wind direction for X_3 (X_4)	Total no. of respon dents
1994	75	1.0	63	2	35	504
1995	65	1.0	40	2	31	51
1996	65	2.0	30	1	24.50	386
1997	50	1.0	52	8	46	243
1998	75	2.0	79	8	13	288
2000	50	2.0	51	8	33	567
2001	75	2.0	71	6	20	418
2002	60	1.0	70	8	23	122
2003	72	1.0	69	4	21	149

Prediction of rain on the basis of the wind direction on *AkshyaTtritya*, equation 1,

$Ý = 44.0119 + 4.6658 X_1 + 0.6054 X_2 - 3.3965 X_3 - 0.1116 X_4$ (R2 = 0.9541)

Where,

Ý = is the predicted value of the crop yield

X_1 = is the direction of the wind observed on *Akshya Tritya* by the largest number of respondents

X_2 = is the percent of respondents for variable X_1

X_3 = is the direction of the wind observed on *AkshyaTritya* by the second largest number of respondents

X_4 = is the percent of respondents for variableX_3

Conclusion

Apart from validating these beliefs across the whole of the Saurashtra, the study has helped to restore the confidence of the people in their traditional knowledge and skill. The resulting knowledge network has brought together the expertise of the region, cutting across formal and informal systems. Such a network helps individual experts to

pool their knowledge and learn from each other. It has predicted droughts and rat attacks for the farming community, a valuable service. In the past, the farmers were often faced with conflicting judgements and predictions made by local experts. Now, the widespread dissemination of the collective judgement of experts has made it easier for farmers to make their decisions.

Our group has already acquired a high degree of credibility because of the successful predictions it has made in the past nine years. In 1994, we got more than 500 observations of the wind directions on *Akshya Tritya* and the day of the *Holi* festival. As a result, we were able to make very accurate predictions. We even predicted the likelihood of a locust attack. This prediction came true and added to our credibility. Since 1996, the golden shower tree has been found to be the best indicator of the onset of the monsoon.

It is this service and the resulting support and appreciation of the farming community that keeps the network going. The network emerged spontaneously and has experienced an organic growth. It exists because of the need that it helps meet. The experimentation and prediction are likely to continue without the help of external support. In the process, valuable meteorological data will be generated and additional beliefs will be tested. We believe that such a network can serve as a model for farmers in other dry land areas who rely on traditional experts for predictions of the monsoon.

Appendix - 1
Names and dates of constellations

S. No.	Name	Approximate dates
1	*Kritika*	10–11 May
2	*Rohini*	24–25 May
3	*Mrigshirsh*	7–8 June
4	*Adra*	21–22 June
5	*Punarvasu*	5–6 July
6	*Pushya*	19–20 July
7	*Ashlesha*	2–3 August
8	*Magha*	16–17 August
9	*Purba Falguni*	30–31 August
10	*Uttra Falguni*	12–13 September
11	*Hasta*	26–27 September
12	*Chitra*	10–11 October
13	*Swati*	23–24 October
14	*Vishakha*	5–6 November
15	*Anuradha*	18–19 November
16	*Jayeshtha*	2–3 December
17	*Mool*	15–16 December
18	*Purvashadha*	28–29 December
19	*Uttarashadha*	10–11 January
20	*Shrawan*	23–24 January
21	*Dharishtha*	5–6 February
22	*Satatitha*	18–19 February

23	*Purva Bhadrapad*	4–5 March
24	*Uttara Bhadrapad*	17–18 March
25	*Revati*	30–31 March
26	*Aswini*	13–14 April
27	*Bharani*	26–27 April

Appendix - 2
Varsha Vigyan Mandal, Executive Committee, Junagadh

S.No.	Name	Designation
1	Dr. D.D. Malavia	President
2	Shri. Dhansukh bhai Shah (Pune)	Vice-President
3	Shri Jeram bhai Timbadiya	Vice-President
4	Dr. M.A. Munshi	Secretary
5	Dr. A.O. Kher	Add. Secretary
6	Dr. P.R. Kanani	Treasurer
7	Shri. R.M. Chandra	Member (Jamnagar)
8	Shri. Sajanbha Sumania	Member (Jamnagar)
9	Shri Mavajibhai Kesarabhai Patel	Member Kutch
10	Shri Ramnikbhai Vamja	Member Junagadh
11	Shri. Dipakbhai Malani	Member Amreli
12	Shri Hasmukhbhai Nimavat	Member Junagadh
13	Shri Jasmatbhai Surani	Member Bhavnagar
14	Shri Pravinbhai Vora	Member Rajkot
15	Shri Jayantibhai Patel	Member Rajkot
16	Shri Kantibhai Joshi	Member Porbandar

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Reclamation of Traditional Knowledge on Snakebite Treatments[Ψ]

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Abstract

Sri Lanka is home to several species of venomous snakes, which may be found in the vicinity of human settlements, especially in rural areas, in plantations and in agricultural fields. As a result, the number of deaths in the country from snakebites is among the highest in the world (six deaths per 100,000 population annually).

Since Sri Lanka is a country whose economy is based on agriculture, it had its own way of doing things. Sri Lanka was a self-sufficient economy before colonization. There is a saying that Sri Lankans were able to overcome all their hardships using their own knowledge. We had great knowledge on different health issues, which includes traditional knowledge on snakebite treatments.

Friends of Lanka (FOL) – Initiatives

Many people in the villages still die because of snakebites. Meanwhile, traditional snakebite healers are moving away from active practice owing to a lack of formal recognition. As a result, there has been a gradual loss in the knowledge of the plants used traditionally for the treatment of snakebites. FOL initiated activities to support research on traditional snakebite treatments. This could be used for policy dialogue to enhance recognition of traditional snakebite healing, as well as of traditional healing as a whole.

Forum for snakebite healers

First, the traditional snakebite healers still working in the area were identified. They included both men and women. FOL found that the number of snakebite healers (75) compared to the population in the area (8000) was amazingly high. Although their major focus is on snakebites, these healers also deal with poisonous arachnids, insects and reptiles, such as scorpions, tarantulas, lizards, wasps etc. After initial meetings, the group of healers decided to meet regularly and formalize the group in the form of an association. They appointed a committee consisting of a president, secretary and treasurer.

The monthly meetings of the snakebite healers association are dedicated to topic(s) agreed upon in advance. Each healer writes down the healing methods used related to the agreed topic, mainly in the form of mantras (chants) and prescriptions of herbal remedies. During the meeting, the healers take turns to share this information. A lively discussion follows each presentation, in which questions are posed, disagreements are put forward and clarifications are made. Important data is recorded by one of the healers. The write-ups of the healers are photocopied and distributed to the rest of the group. In this way, each healer has collected about 300 healing methods for poisonous bites.

[Ψ] The full text of these papers are currently not available and hence the abstract alone has been presented here.

Preparation of rare medicines

During these meetings, special attention is also given to the medicinal herbs and plants used for the treatments. With the loss of biodiversity, and with healers moving away from active practice, many of the herbs and plants needed for snakebite treatments are gradually disappearing. The older generation of healers still have a vast knowledge of medicinal plants – both wild and cultivated.

The need to conserve the medicinal plants and related knowledge became clear during the meetings of the healers. They started bringing samples of plants to the meetings and discussing their medicinal characteristics. In addition, many of them are now propagating the plants in their home gardens, in order to build up small herbal gardens.

Coming together as a group has also allowed healers to undertake the preparation of several rare medicines that many of them could not have prepared on their own. Sometimes, this was due to lack of finances, the inability to access the necessary medicinal plants or not being aware of the necessary mantras required for their preparation. The healer with the necessary experience would invite the other healers to join him in the process of preparation of the medical remedy and learn from it. These medicines are then shared among the whole group; the healers view this as a great benefit

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Experiences of traditional snakebite healer Mrs. L. R. Podimenike from Kankeeriya

"I am very happy about this association. I learnt the healing from my father and treat people whenever they come to me. But, I had more or less given up on active practice, as I felt that traditional healers are not recognized. But, now I am encouraged to continue and start active practice again. I have learned a lot from the more experienced healers at the meetings. Access to the medicinal herbal oils and pills is of great advantage to me, as I would not have been able to prepare these on my own. I have started to propagate some medicinal plants and hope to have a small herbal garden of my own soon."

Registration of healers

According to national regulations, any person involved in alternative medicine is required to be registered with the Department of Indigenous Medicine. Unlike practitioners of recognized indigenous sciences, such as Ayurveda and Siddha, the criteria laid down by the government makes it difficult for traditional snakebite healers to receive such registration. In such cases, the healer is interviewed by an evaluator of the Department of Indigenous Medicine, who then gives a recommendation for or against registration. The social acceptance gained through such registration is highly valued by traditional healers.

This issue of formal recognition has been discussed quite extensively within the group. FOL has maintained that the healers do not need to seek formal registration at this stage. Instead, they need to build up sufficient confidence in and get social recognition for their group, and show their record of success. The data collected by the group should be sufficient proof of this success: from the approximately 33,000 persons who sought treatment, no fatalities have been reported. However, some of the healers in the group are strongly motivated to seek registration. Therefore, the president of the association has arranged for an evaluator of the Department to visit the group and conduct the interviews.

Further exchange

Joining the Compas network has enabled the group of traditional healers to get in touch with other healers through visits to other Compas partner organizations in Naula (in Sri Lanka) and South

India. Naula Rural Development Foundation, operating in North-central Sri Lanka, is considered to be the seat of traditional knowledge in many areas, including medicine. Therefore, the healers were very interested in meeting their counterparts in Naula. The trip was organized by FOL and provided an opportunity for the healers to share experiences in snakebite treatment.

In addition, they were also very interested in learning more about the spiritual aspects used in Naula for protecting crops from elephants and other wild animals. They identified areas where they could exchange experiences in the future. The exchange visit to South India was organized by the Regional Co-ordinator of the Compas Network. One of the members of the snakebite healers' forum took part in this exciting learning experience. FOL has also organized two meetings between snakebite healers and people from GOs and NGOs in the area. The two main issues on the agenda have been the need to conserve biodiversity, particularly of medicinal plants, and recognition of the knowledge and skills of traditional snakebite healers. During these meetings, five healers from the association presented their first-hand experiences. One of the points that attracted the attention of the participants was the success rates mentioned by the healers. Such events contribute to a gradual change in the attitudes of government officials and NGO staff towards the relevance and potential of indigenous practices.

Traditional Orthopaedic Practices of Southern India – A Pilot Study

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Abstract

Bonesetting is one of the key specialties of local health traditions (LHTs) in rural India. Because the current government and private institutional facilities are neither adequate nor suitable to cope with the patient load particularly in rural areas and because the cost of diagnosis, medicine and surgery in modern hospitals is high, people depend on locally available facilities. It is estimated that there are approximately 60,000 bonesetters in rural India whose functions include fracture and dislocation management, marma chikitsa/varma kalai (understanding vital points in the body), management of injuries and their complications and management of conditions such as congenital anomalies like club foot etc.

Given the large presence of bonesetters, it was felt that there was a need to clearly understand and endorse the strengths and address the weaknesses of this tradition. The unique aspects of traditional bonesetting such as bandaging techniques, management of inflammation, the art of varma (an anatomical understanding of the vital points in the body) in the treatment of fractures and dislocations, methods for early healing of fractures and the strengthening of bones by the use of certain medicated oils and pastes etc, are promising research areas in community health, and there is a need for such research. But so far, no comprehensive study has been carried out in this field.

In order to understand the status and the reach of traditional bonesetters in South India and to understand the clinical efficacy of their management, the Foundation for Revitalisation of Local Health Traditions, Bangalore, initiated a pilot project in 2002 under the ETC-Compas programme on endogenous development. A survey conducted in 25 districts of Tamil Nadu revealed that there are more than 400 active bonesetters. In order to study the efficacy of traditional fracture and dislocation management methods, 40 patients who had had X-rays taken before and immediately after reduction were studied, and a follow up was carried out after 45 days. It was found that some bonesetters manage compound forearm fractures that need surgical intervention and dislocations in a relatively simple way. However, a number of deficiencies in their management strategies were also noted.

This paper shares the experiences of a three-year study in the area of traditional bonesetting.

Introduction

Bonesetting is one of the key specialties of local health traditions (LHTs) in rural India, which may be because current government and private institutional facilities are neither adequate nor suitable to cope with the patient load particularly in rural areas, and hence, people depend on locally available facilities. In modern medical management, the cost of diagnosis, medicine and surgery is quite high compared with that of bonesetting through traditional methods. It is estimated that there are approximately 60,000 bonesetters in rural India whose functions include fracture and dislocation management, *marma chikitsa/varma kalai*, management of injuries and their

complications, management of complicated conditions such as congenital anomalies like club foot etc., application of different types of oil therapies and many other functions that have yet to be explored. This knowledge has been passed on through centuries of practice from one generation to another. Mostly, the knowledge is inherited as a family tradition, and in some cases, it is taught as a *guru–shishya paramparya*.

From a public health point of view, it is a fact that the reduction of fractured bones falls under the category of specialty treatments that are secondary and tertiary referral systems in the formal healthcare systems of the country. A serious attempt to encourage effective traditional practices in this area along with the correction or discouragement of the faulty practices is the need of the day. There should also be recognition for the practices that are effective and for the valuable service these traditional systems extend to the rural poor and, to some extent, the urban needy.

So far, no comprehensive study has been done in this field. No supporting evidence is available so far apart from past micro level studies conducted by the Foundation for Revitalisation of Local Health Traditions (FRLHT) and other NGOs with similar interests. These studies throw light on the fact that approximately 60,000 bonesetters are serving the rural population of developing India.

In order to understand the status of traditional bonesetters in South India, FRLTH initiated a pilot project in 2002. Three activities, listed below, were carried out as a part of the project. The objective was to conduct a survey and make an inventory of bonesetters and *marma* practitioners in some states of South India. Another objective was to make a comprehensive clinical documentation of the selected bonesetters and the cases managed by them.

1. An inventory survey to identify bonesetters and orthopaedic practitioners in the selected states of Karnataka, Kerala and Tamil Nadu.
2. A comprehensive documentation of selected practitioners (to understand their strengths and weaknesses).
3. Development of a methodology for a participatory assessment of bonesetting traditions.

The first two objectives are discussed below; work on the third is still being evolved.

1. Inventory survey

The inventory survey asked the following questions: What is the total number of traditional bonesetters practising in the four states? What is the state of the traditional bonesetting system in these states – is it spreading or eroding? What is the area covered by the vaidya and his successor in their practice and what is their social, economical and political status in the community? The following methodology was used for the survey.

Data collection tools

The data collection tools were structured questionnaires developed exclusively for the programme. These were field tested in two locations in Kerala and modified further for the study. The data entry forms were created using Microsoft Access.

Orientation programmes for the field volunteers

Field volunteers were given training regionally. Two such training programmes were conducted, one at Thrissur and one at Pondicherry. These training programmes involved familiarization with the tools of documentation including field level exercises of actual documentation visiting the practitioners.

Training on data entry software was also organized for the field volunteers at FRLHT so that the data from the survey could be digitalized later on.

Sampling

The study had adopted a purposive sampling method by identifying the practitioners through knowledgeable people in the respective localities. Communicating with the existing networks and individuals was also adopted to identify the individual practitioners.

Data collection

Field volunteers carried out the data collection through individual interviews of the practitioners. A field co-ordinator from a collaborating agency further verified this.

Data crosschecking

Data crosschecking was designed to be carried out at three different levels. The initial two levels of verification were carried out at the time of the data collection itself. The third level was carried out by seeking public opinion about the local *vaidya*. Local villagers/public were interviewed and data was collected on their opinion about the *vaidya*. Apart from this, the research fellow co-ordinating the field survey and documentation randomly crosschecked 10% of the questionnaires in order to rule out any lack of integrity in the data.

Limitations of the study

The study was limited to select areas of the states and may not give an ideal representative picture of the tradition's length and breadth in the country. As the traditions in *marma* and bonesetting are always interlinked and used synonymously, it was not possible to make a further classification in the initial survey. Not all the cases were crosschecked for the data shown at a secondary level. This was also applicable for the cases or claims of treatments.

Analysis of the inventory survey

Out of the 410 *vaidyas* questioned in Tamil Nadu and Pondicherry, *Vaidya* K. Chinniah Gounder, from Theni, Tamil Nadu was found to be the *vaidya* with the longest traditional history, up to 10 generations. The other *vaidyas* range from 1st to 7th generation *vaidyas* (see Table 1). *Vaidya* K. Chinniah Gounder, son of Krishnasamy Gounder, aged 76, from Mayiladumparai post, 1 ward, Andipatti, Theni district of Tamil Nadu has 35 years experience.

Table 1

S. No	Generation	No. of *vaidyas*
1	10th	1
2	7th	5
3	6th	2
4	5th	13
5	4th	33
6	3rd	89
7	2nd	113
8	1st	19
9	No generation	135

Age group

The age group of the 410 *vaidyas* can be divided into four categories (see Table 2).

Table 2

S. No.	Age group (years)	*Vaidyas*
1	10–20	5
2	21– 40	83
3	41– 60	214
4	Above 61	108

Community

Totally, 59 castes have been recorded in Tamil Nadu and Pondicherry. Thirty-nine *vaidyas* in Tamil Nadu hail from the caste named Gounder.

Number of patients

The total number of patients being consulted by each *vaidya* was calculated on a per day/week/ month rate. An analysis of the survey data indicates that there are many bonesetters who see a good number of patients, for example, up to a maximum of 200 patients per day.

Fee structure

Questions regarding fee structure were divided into five categories: free consultation/whatever the patient can give/payment in kind/cash payment/form of payment not recorded (NR). From this study, it was clear that there are more *vaidyas* who consult for cash than for the other types of remuneration. It was found that among the *vaidyas* interviewed around 50% took their consultation fees in the form of cash. *Vaidyas* who accepted anything that the patients could give, either payment in cash or in kind, were very few in number. It was difficult to carry out a complete analysis of this data since a large number of questionnaires did not contain filled data in response to this question.

Outreach

The area covered by each *vaidya* has been recorded, i.e., how many villages, Taluks, districts and states are covered by each. The information obtained in the field is not reliable because most of them do not maintain any register giving an accurate record of the areas covered by them over the past days/months/years. According to the data collected, there are some *vaidyas* who cover a larger area than most.

1. Two *vaidyas* cover 900 villages
2. Four *vaidyas* cover 50 Taluks
3. One *vaidya* covers 3 states

Diagnostic tool

It was noticed that 78 vaidyas out of 410 could read X-rays.

Special cases attended – techniques

Some traditional bonesetters have their own methods of diagnosing/ management/ making preparations etc. Some of the methods that were found during the survey are given below.

Management

It was noticed that there were some unique practices in treatment. Usage of materials such as ropes, water and coconut leaf veins for massage, immobilization and management of dislocation were some of the unique features noted. It was also noted that treating fracture cases with the understanding of *varma* was still prevalent. Many unique oil preparations and other internal medicines to promote the union of the fracture were also noted. Some mantras used for healing were also noted.

Specialization

Traditional bonesetters are categorized into four according to their area of specialization: fracture management, massage therapies, orthopaedics (marma practitioners) and fracture management along with general practice.

Table 3

S. No.	Specialization	No. of *vaidyas*
1	Fracture management	299
2	Massage	21
3	Orthopaedic (*marma*)	36
4	Others* (*vaidya* treating general cases including fractures and dislocations)	54

* Includes treatments like those for rheumatic disorders, mantra treatment, *visha chikitsa*, treatment for cancer, steam treatment, *thadavu, thirumal, kizhi, uzhichal* etc.

Districts covered in Tamil Nadu and Pondicherry

Table 4

State	District	No. of *vaidyas*	Total
Tamil Nadu	Cuddalore	3	**403+**
	Dindigul	27	
	Erode	25	
	Karur	2	
	Madurai	16	
	Namakkal	28	
	Nilgiris	10	
	Perambalur	5	
	Pudukottai	16	
	Ramanathapuram	10	
	Sivagangai	14	
	Theni	17	
	Tuticorin	7	
	Tiruchirapalli	27	
	Villupuram	12	
	Virudhunagar	23	
	Coimbatore	8 +	
	Dharmapuri	17+	
	Tiruvannamalai	104	
	Tiruvallur	2	
	Kancheepuram	4	
	Chennai	2	
	Kanniyakumari	15 +	
	Vellore	9	
Pondicherry		7	**7**
Total			**410 +**

2. Comprehensive documentation of traditional bonesetting

Another activity that was carried out to meet the objectives of the study was a comprehensive documentation of some of the fracture management techniques practiced by the selected healers. The objective of this was to understand the efficacy of the treatment; the unique techniques used for diagnosis, treatment and medicine preparation and the reason why lots of people go to *vaidyas* for treatment.

Methodology

Selection of vaidyas and patients for the comprehensive documentation was carried out using the following criteria:

Inclusion criteria for the selection of vaidyas

- Those who accepted the comprehensive documentation
- Those with experience (more than 5 years)
- On the basis of the number of patients treated per day (minimum 10 patients on average)
- Those currently practising
- Those who were communicative
- Those with a X-ray unit of their own or where one was accessible nearby

Inclusion criteria for the selection of cases

- All fresh cases of fracture or dislocation
- Those cases where the patients gave their consent (oral)

Exclusion criteria for cases

- Cases distorted due to mismanagement
- Those cases that needed intensive care (emergency care)
- Complicated cases
- Medico-legal cases
- Those cases involving patients below 10 years old or above 60 years old
- Those cases involving diseases (due to which fracture healing gets delayed) and pathological problems

Documentation and follow-up

The selected cases were recorded using a specified questionnaire for the comprehensive documentation and using X-rays as the minimum diagnostic tool. Documentation of a minimum of five fresh cases of fracture or dislocation was carried out in each of the selected centres before and immediately after reduction. The follow-up of these cases was carried out after a period of one month to 45 days.

After the study in the five centres, a data analysis was carried out with comments from orthopaedic as well as Ayurvedic experts. It was noted that in around 40% of the cases there were some minor and major complications. The following is a chart giving a summary of the findings (Table 5).

Table 5

S. no.	Pilot documentation	No. of cases recorded	Results		
			Proper management	Complications	Others
1	Centre I	Five	One	Three	One to be followed up later
2	Centre II	Four	One	Three	Follow up was not done
3	Centre III	Four	One	Two	One to be followed up
4	Centre IV	Four	Two	Two	Follow up later
5	Centre V	Eight	Six	Two	-

Conclusion

This is an ongoing study; however, it has thrown light on some of the strong as well as weak aspects of bonesetting as carried out in certain locations of the country. The above study was a helpful way of learning about the extent of bonesetting traditions and the diverse practices involved in a particular geographical area within a specified timeframe. In order to draw more rigorous conclusions, there is a need for a team of orthopaedic experts to look further into the critical aspects of bonesetting. This will pave the way for dialogue, sharing and learning between Ayurveda, Siddha and modern orthopaedics as well as traditional bonesetting. There is no doubt that traditional bonesetters are spread out in a similar way in other parts of the country and their services are indispensable at the rural level. There is a need to critically appraise and recognize the contributions that they have already been made to public health. With appropriate training interventions, current gaps in these practices can be filled and these practices can be further strengthened. This will be a big step towards creating a more affordable and accessible community healthcare system in the area of orthopaedics in the country.

Advocacy for Recognition of the Dai (India's Traditional Midwife) - A case presentation by CHETNA

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Abstract

Indigenous midwifery is one of the finest examples of traditional wisdom and skills possessed by women and is learnt through observation and years of apprenticeship and has been transferred from women to women through the generations. Since ancient times, pregnancy and childbirth have been in women's domain. Women give birth at home with the support and encouragement of the elderly, experienced and skilful women of the neighbourhood. In most traditional rural societies in India, women still continue to practice their wisdom to bring humanity into the world. Men are sometimes called in to give a helping hand in the case of difficult births or to provide support.

In most of the rural remote, tribal and urban slum areas of India, the Dai's role is central to facilitating birth. The Dai mentioned above is India's traditional midwife, also known as dai-maa in Hindi, daayan in Gujarati, suin in Marathi, Pathichhi in Malayalam and so on. The word Dai stems from daayi – meaning "one who gives". The public health system refers to the Dai as a "traditional birth attendant" (TBA).

Since maternal mortality has stagnated across the globe, and India ranks among the countries with a high maternal mortality rate, there has been a shift in the global world-view for institutional childbirths with skilled attendants. As a result, the role of the Dai is perceived as she who provides facilitation institutional births. With 65% of births in India taking place at home and with 41% of these births being assisted by Dais and looking at the present health infrastructure and women's access to healthcare services, the best possible strategy is to recognize and strengthen the role of the Dai in safe home births, aptly supported by functional essential obstetric care.

Overlooking Dais because they cannot reduce maternal mortality is a direct threat to indigenous midwifery skills. The danger is therefore marginalization of Dais, who are available, accessible and affordable and are usually from the lower socio-economic strata of society. While skilled attendance at the time of delivery could save the lives of 15–20% of the women who develop complications, there is a danger of depriving 80% of women of the woman-centred, culturally sensitive, available, accessible and affordable obstetric care provided by Dais. Also, the danger lies in marginalizing a whole range of traditional, Dalit, tribal, Adivasi and poor women from their age-old profession.

For the past two decades, CHETNA has been actively involved in ensuring safe home births by strengthening the Dai tradition. As the result of a decade long advocacy effort, seven Dais and CHETNA along with leading NGOs of Gujarat have formed a Dai Association that has been recognized by the Government of Gujarat. The Association works towards the recognition of Dais at the state and district levels and has plans to expand into other states and countries. This paper looks into the salient features of the Dai tradition, reviews the efforts made by the public health system and NGOs and describes the advocacy efforts being made towards the recognition of Dais including the Dai Association, Gujarat.

Introduction

In most South Asian countries, in rural as well as urban poor communities, around 65% of childbirths take place at home and most are attended by traditional birth attendants (TBAs), or indigenous midwives widely known as "Dais". The Dai's role in childbirth has been recognized by the community and is one of the finest examples of traditional midwifery skills passed on from one woman to another. She is the only traditional healer recognized for maternal and newborn care by public health systems.

However, as global eyes turn towards stagnated maternal mortality and the need for institutional childbirth and skilled assistance at the time of delivery emerges as the only strategy for reducing maternal mortality, traditional Dais are being pushed towards the periphery thereby de-recognizing their traditional skills of childbirth.

Global policy focuses on creating new skills rather than on training and supporting the virtually illiterate traditional Dais. On the whole, Dais are intelligent, strong in character, trusted in their communities and experienced in childbirth. Naturally, the question arises, isn't it sensible (till a cadre of skilled birth attendants [SBAs] is built up) to support, strengthen and optimally utilize this existing resource pool of TBAs?

Ample evidence in India, South Asia and other countries indicates that, when supported by functional essential and emergency care services, Dais can significantly contribute to reducing maternal and neonatal morbidity and mortality. Dais can be key to linking women's homes with essential and emergency hospital care.

Communities have needed the village midwife or Dai since time immemorial. Traditionally, her services have been part of *jajmaani* and *balutedari* (feudal labour-exchange systems in North and West India). In her relationship with village women, there is mutuality, a cultural consistency and an appropriateness of skills. Easily accessible to women, knowing their concerns, she provides care during childbirth and afterwards. On the other hand, traditionally Dais come from the lowest castes and hold no social power.

While skill transmission among barbers, dhobis, carpenters and leather-workers is "male", the handing down of midwifery skills is "female". Typically passed from mother-in-law to daughter-in-law, the occupation has stayed unstructured, never growing into a "profession" in contrast with the male trades. Now more than ever, it faces suppression and extinction by gender power politics at all levels. The government has ambivalently wooed Dais through training programmes, leaving them when it comes to support services. Their age-old skills are eroding.

This paper aims to develop an understanding of traditional midwifery and its role in providing women-centred, gender-sensitive care at home and also in linking homes to health facilities.

The Indian context

> "In a rural village in Barmer, Rajasthan, Rasi was giving birth for the sixth time. During her pregnancy, she had not received any care. When she went into labour, the village Dai was called. In the midst of her labour, she started to bleed. The Dai immediately asked her husband to arrange for a vehicle as Rasi's condition was critical. He

walked for half an hour to reach the nearest town where the nurse stayed. Somehow he managed to find her, but by the time they had both walked back to Rasi's village, it was too late."

As told by Rasi's sister-in-law to an NGO worker in Rajasthan.

The above real life incident depicts the reality faced by most women of the remote, rural areas of Rajasthan, one of the states with the highest maternal mortality rate (MMR) estimates (667/100,000 live births), and is representative of similar situations in other states. Community needs assessment in six rural, desert districts of Rajasthan indicates that

- 81% of births were conducted at home.
- Dais conducted 75% of the deliveries, auxiliary nurses and midwifes (ANMs) conducted 9% and family members conducted 7%.
- On an average, the distance to the nearest Primary Healthcare Centre (PHC) ranged from 1.5–50 km, i.e., about 20 minutes to 6 hours away.
- The distance of the district hospital, where emergency obstetric care was available, was 13–100 km, i.e., 1–7 hours away.

In most of the rural remote areas and urban slums of India, home births attended by Dais are a reality; institutional deliveries seem a distant reality, as the infrastructure that would be required is immense. The need of the hour is to make home births safer while working towards improving infrastructure. In the Indian context, the Dai is a critical actor in making home births safe as she is available, accessible, affordable and an accepted resource at the community level.

Who is a Dai?
The Dai is India's traditional midwife, also known as *dai-maa* in Hindi, *daayan* in Gujarati, *suin* in Marathi, *Pathichhi* in Malayalam and so on. The word Dai stems from *daayi* meaning "one who gives".

The socio-cultural profile of the Dai

The village Dai is usually a middle-aged woman of Dalit or oppressed caste and is poor. Certain subcastes of oppressed and Dalit castes perform the role of the Dai. The Dai is a part of the *balutedari* or the *jajmani* system, by which trades in Indian societies have been traditionally arranged. In many states, women of the *naai* (barber) caste may perform the Dai's role, perhaps because of their connection to the surgical trade and instruments. Likewise women of the *chamaar* (leather-worker) and the *basod* (bamboo weaver) castes are Dais. Among Rajput *Thakurs*, elderly experienced women of the extended family support woman during childbirth; Dais are often called upon to cut the cord and remove the dirt. In most communities, she is an integral part of the community health and healing systems.

Most Dais have not received any formal education. Hence, they are usually illiterate or barely literate. But their learning from life experiences provides them the necessary skills through apprenticeship and experience.

A Dai usually has the experience of giving birth to several children of her own. As a young girl, she accompanies her mother, mother-in-law or an elderly aunt and

learns while observing the process. Gradually, she starts assisting, and later on, when she gains confidence, she delivers a child on her own, with another learner by her side. Usually, the Dai has 5–10 years of informal learning exposure before she practices on her own.

> "My *kaki sasu* (husband's aunt) used to do this work. When I got married, she assisted me during the birth of my children. I got interested and started accompanying her. She used to tell me how to manage labour, and I used to do the odd jobs. Then, she used to let me handle the labour at various stages. She once asked me to conduct a delivery in her presence, as she was not feeling well. This gave me confidence, and from then onwards, for the past many years now, I have been doing this work."
>
> A Dai from rural Gujarat

However, some Dais start the practice earlier when they are compelled to support a woman in crisis and then continue the work in interior communities as a philanthropic gesture.

> "On my way to the nearby village, I saw a woman going into labour by the roadside. I panicked but could not leave her in that state. I am a mother and have the experience of giving birth I told myself. I supported her and took her to a secluded spot and assisted her. I used the clean end of my sari to tie the cord and a blade of grass to cut it. The mother and her baby are hale and hearty even today. From that moment, I got the confidence to conduct deliveries. I decided to help women of my villages in their hour of need and have been doing so for the past ten years."
>
> A Dai from Gujarat

Some take up this work because of their association with an NGO.

> "SARTHI, an NGO, trained me as a barefoot veterinary worker. When I started giving treatment to cattle, I realized that there were no trained Dais in my village. The PHC is 15 km away from my village, and women had to go to the CHC (community healthcare centre) in neighbouring towns when they were in a critical condition. Women and children used to die on their way to hospital. I participated in the Dai training programme. I went to the PHC and CHC to enquire about their services. On the day the ANM comes to our village, at the fixed time, I collect all the pregnant women for check-ups and immunization. I also motivate them to go to the Anganwadi and eat the food supplied. I also participate in the monthly meetings at the PHC and collect iron tablets and Disposable Delivery Kits (DDK). Through my efforts, I have been able to motivate women to avail the services and healthcare provided by the

> government. Earlier, they were aware of the services but did not avail them. After I started this work, they have started availing them."
> Chanchiben, a Dai from Gujarat

Most Dais work as labourers or in agriculture. They support women in labour as a duty towards their communities and to assist women in need. The communities happily reward them with gifts like a sari, grains, coconuts etc. and, at times, a little money. Most of the time, it is left to the families to decide what they would like to provide on the basis of their capacity. Many times, the Dais wait for hours together without even a cup of tea and usually end up receiving hardly any money. At some point of time, a Dai may negotiate and demand remuneration for her services. Hence, most Dais remain in poverty. With more and more families reducing the number of births, the Dais are losing business, which is affecting their meagre income.

The Dai speaks the same language as her patients and is an integral part of the religious and cultural system of society. She enjoys the full faith and trust of the village women with regard to their own health and that of their children's. When any problems related to gynaecology arise, village women consult the Dais. They possess midwifery skills and are trusted counsellors for women during pregnancy and delivery and for the care of newborns. In the majority of cases, the Dai is the only person available at any odd time and all the time, round the clock in the village.

> "We do this work because it is *dharam ka kaam* (religious work). We walk long distances, wait for hours together and risk our lives to go at any time to toil with a woman. Still, we get very little money. If the family is poor, we may not even get a cup of tea. Some families give us some grains or old clothes, whereas some give us Rs.50–60."
> A Dai from the State of Maharashtra during a healers meet organized by CHETNA.

> "I am a skilled person. I have delivered most of the young people of this village. The entire village respects me and listens to my advice. Once, there was this family whose daughter was very young and weak. My assessment was that she would not be able to take the pain. I advised her to go in for a hospital delivery. Her parents agreed, and today she is happy with three daughters."
> A Dai from rural Gujarat

Ayurveda, the ancient science of life, one of India's formal, institutional traditional health systems, strongly recommends birth in a home that is equipped to take care of birth and birth-related concerns and with the help of experienced and wise women; this indicates the critical role of women during childbirth.

About the Dai's healing knowledge and skill

Complaints of dizziness, lumps in the body, morning sickness, broken hearts, internal disagreements and worries, birth of a calf, property problems, delayed labour and so

on are handled by Dais. Women and men confide in her and consult her with varied problems. Most women experience her warmth and the deftness of her skills during a trying period in their lives.

The Dai performs elaborate to modest ceremonies to invoke the goddess of birth and prays for a safe delivery, to pacify a violent husband and to engage him in caring for the mother and child.

A Dai is the original practitioner of comprehensive medicine. According to anthropologist Karen McCarthy Brown, she combines the skills of a medical doctor, psychotherapist, social worker and priest. Dais heal women and men in the context of their families and society, taking into account the cultural, physical and spiritual contexts.

> "As soon as I enter the house of a woman in labour, I ask the family to bring warm water to wash my hands and feet. Then, I ask the women of the house to unlock all the locks in the house. (This symbolizes the opening of the cervix). I assess the woman's condition and inform the family accordingly. I also ask the woman in labour to separate a mound of flour with a coin (symbolizing separation). Then, I coax the woman to squat and then to bear down. I also massage the cervix and the passage with edible oil and hold the baby carefully when it pops out."
>
> A Dai from the State of Uttar Pradesh

The community believes that the process of childbirth is understood not only in physiological terms but is also woven in the cultural and religious ideologies of women and communities. Childbirth is viewed as not just a physical process but also as an act of bringing a soul to the earth. Special goddesses facilitate childbirth processes. Each community has its particular deities whose blessing expedites childbirth and protects women.

It is within this matrix that the Dai works, not only as an accomplished herbalist and a childbirth facilitator but also as a ritualist. She adopts various rituals to invoke the goddess of birth and seeks her blessings for a safe birth. She functions as a mediator of the divine energy, channelling energies or ancestral knowledge.

Labour therefore is a process of opening up and separating two souls and various rituals are performed accordingly. For example, the Dai may ask the women to undo their plaits or to unlock all the locks in the house or to separate a mound of flour in to two using a coin.

Rituals are helpful in facilitating a woman's labour – imagery acts as an interface between mind and body, bringing what in physiological terms is considered an involuntary process at least partially under conscious control (Chawla, 1994).

The client-woman is actively engaged in childbirth processes through dietary modifications during e pregnancy and through rituals and rigorous regimens during labour. These are measures for the woman in labour to connect herself with the internal and external environment. One would expect love, respect and benevolence from the community for carrying out the noble work of assisting in childbirth. But many times, the Dai is down-trodden by caste and tradition, though humanistic values bind her to serving others. Her work is often taken for granted, and she goes

without recognition or reward and sometimes with insults. Often her work is ridiculed and her role and services ignored.

Dais are thus a rich resource available at the village level to address women's health concerns. On the one hand, they possess the necessary midwifery skills, and on the other, they command the respect and trust of the community. In addition to this, they are the only persons available at any odd time and all the time round the clock in the village. Being a resident of the same village, the Dai knows each family personally and the status and history of most of the women of the village.

> "We have to be ready to go out at any time. We face the additional threat of violence from some village people, particularly when we protest. Many times, after a long day, when we are about to retire for the day, a call comes. At night, it is even more dangerous as the area is full of snakes and there are no lights or roads. At times, I ask the person to bring a cycle. If he/she cannot, I have to walk for miles."
>
> Dai (*suin*) from a rural area in the State of Maharashtra

The evidence base

Various international authorities have emphasized that integrating Dais into the public healthcare system is important for community health.

- "Where the use of TBAs is strongly rooted in local customs, it is beneficial to:
  - Train TBAs to avoid harmful practices during delivery (and use good practices), recognize danger signals and refer complicated cases to higher-level care.
  - Establish or strengthen links between TBAs and the formal maternal healthcare system
  - Ensure that health centres and hospitals will accept referrals from TBAs." (Anonymous, 1998)
- "Where TBAs account for significant proportion of deliveries, safe motherhood programs should include activities aimed at providing adequate supervision and integrating them in to the health system."(Anonymous, 1997).
- "The traditional midwives can provide culturally appropriate nurturing in the community setting; offer a first line of link with the formal healthcare system. However, Dais alone in absence of back up from a functioning referral system and support from professionally trained health workers cannot ensure safe motherhood." (Anonymous, 1999.)
- Experiences from Sri Lanka, China, Cuba and Malaysia indicate that establishment of community-based maternal healthcare systems comprising pregnancy, delivery and post- partum care and a system of referral to a higher level of care in the event of an obstetric complication is the key to ensuring safe home births. In Bangladesh, services of a trained midwife (not a Dai) have been useful in making some differences in maternal mortality.

- China (rural) and Fortezela, Brazil, were able to bring their MMRs to 115 and 120, respectively, using the following model:
  - Lay provider recognizes complications
  - Family or provider organizes access to essential and emergency obstetric care
  - Functioning emergency obstetric care available

Role of the Dai in home births

Dais provide affordable basic maternal care at home

In half of the major states of India – Assam, Bihar, Haryana, Himachal Pradesh, UP, Kerala, Punjab, Rajasthan – the total cost of treatment to the patient (excluding cost met by the government) is higher in public hospitals than in private medical care. While public institutions provide normal delivery care at nominal or no cost to the user, the opportunity cost (Rs.57 per day per patient (source: NSS, 1992,418,437,516; Independent commission on health in India) makes deliveries in a public institution costly. The poor utilization of public services further increases the cost of care. Loss of daily wage, transport, supplies and other costs to the user make institutional deliveries almost unaffordable.

Dais are available in the village. They are the critical link between the community and the public healthcare system. If trained properly, the Dais can provide essential obstetric care at home, leading to minimal disruption in the client's day-to-day living. A normal home delivery by a trained Dai could cost anywhere between Rs.100–500. Hence, strengthening the system of Dais is an affordable strategy towards safe home births.

Dais supplement the human power needs for safe motherhood

Considering the population covered by a PHC in rural area, it can be estimated that the PHCs conduct 900 deliveries per year. There is a chance that complications will occur in 15% of these. Therefore, a minimum of 750 normal and 150 complicated deliveries are estimated at the PHC. Most PHCs in India are hardly equipped to cater to this load.

There are more than six lakh Dais in India, assuming that there is one Dai per village, and they facilitate 80–90% of all childbirths in remote, rural areas and about 40% of those in urban slums.

In a situation where distances to public healthcare and availability of trained gynaecologists and obstetricians in rural, remote areas are a concern, Dais are the human power resource of public healthcare.

Dais help in reducing delays in referrals

The difficult geographical terrain, the socio-economic-cultural context and poor infrastructure obstruct easy and timely access to PHCs, particularly during emergencies.

Dais are accepted by and respected in communities. They play a critical role in mobilizing the community when complications occur and, if empowered through

training and supporting services, can help in early identification of complications and ensure timely and appropriate referrals.

When supported by functional, efficient, sensitive referral services, training Dais has resulted in identification of complications and ensuring early referral, thereby reducing the number of deaths due to two – identification of complications and timely referral – of the three delays.

> "Rama was giving birth for the third time. A local Dai facilitated her labour, and she gave birth to a beautiful baby. Immediately after the delivery, she started to bleed. The Dai, alarmed, asked the family to rush for a vehicle and shift her to the hospital, which was an hour's journey away. Meanwhile, she started giving Rama fluids and reassured her. She was trained to keep the patient's foot end elevated, which she did, and she wished she could somehow stop the blood from flowing. Rama's family was running helter-skelter for a vehicle and half an hour's effort yielded no results. Luckily for Rama, a local NGO came for a visit. Realizing the threat to Rama's life, they readily lent their vehicle. Rama's life was saved."
>
> A case study from Alwar district in rural Rajasthan

> "I was trained as a Dai by a local NGO. A family called me for a consultation when their daughter was seven months pregnant, for the first time at the age of 17. A look at the daughter and I could make out that she was very weak. I informed the family about the care to be taken and advised them to go in for a hospital delivery. Respecting my suggestion, the family did so, and their daughter and her baby are healthy and happy."
>
> A Dai from a rural area of Gujarat

> "I have undergone training organized by my organization as well as by the Primary Healthcare Centre. They taught me about cleanliness and the other conditions that pose a threat to a woman's life. When I come to the hospital, the doctor always greets me, enquires about my work and asks whether I faced any problem in the field. I feel good. When the ANM comes to my village, she comes to my house first and then we go together for a visit to the women that I have identified. Sometimes, I call the women to my house at an appointed time and we discuss pregnancy care and numerous other things. The nurse is very friendly and comes regularly and takes good care of my women."
>
> A Dai from rural Gujarat

Dai mobilizes the community for safe motherhood

Women die while giving birth not only because of medical complications but also because of the cumulative effect of social injustices, which begin with female foeticide and infanticide and include teenage pregnancies, botched abortions, too many

pregnancies too close together and frequent pregnancies throughout the reproductive years.

For example, cephalo-pelvic disproportion can be treated medically, but to prevent it, there is a need to ensure that girls get proper nutrition right from childhood. This calls for action to eliminate gender biases at the community level.

As Dais are socially and culturally accepted and as they help communities and women during their critical periods, they enjoy the status of a power figure. They therefore command the respect of the community and can become an agent for social change.

> "I was a contract labourer in a nearby quarry. The need to do something to prevent numerous women and children from dying during delivery prompted me to participate in the Dai training programme organized by my NGO. I started working as a Dai. Women and men were not aware of the care to be taken during pregnancy, childbirth and after childbirth. I conducted meetings to impart education on these aspects. Now, families in my village accept immunization. Earlier, there were many food taboos, but now the families have changed and pay more attention to women's nutrition.
>
> Earlier, the ANM was irregular; I went to the PHC and informed the medical officer about this. He assured me that from now onwards, the ANM would come regularly, but that I would have to co-operate with her, I went back and conducted a community meeting. I informed the community about my role as a Dai and also about my discussion with the Medical Officer. They took this as a positive step.
>
> Now, the ANM comes to our village regularly, and all the women and children get immunized as per schedule. Women get iron tablets and DDKs regularly."
>
> A Dai from Panchmahal district of Gujarat

CHETNA's efforts

The Dai is looked upon as a social resource, available, accepted, accessible and affordable to most women in remote rural and tribal communities. Hence, efforts are being made to strengthen this resource base by capacity building.

Study of Dai practices

In collaboration with the Lok Swasthya Parampara Samvardhan Samiti (LSPSS) and 26 field- based NGOs, CHETNA conducted a study of traditional practices during pregnancy, labour, after childbirth and for newborns and child care. Around 2500 women and Dais from 12 states of India participated in the study to share their traditional knowledge and wisdom.

The study clearly indicated the positive role played by traditional practices and the Dai tradition in strengthening the health of women and children, and at the same

time, it laid emphasis on the need to provide supporting primary healthcare and referral services.

Training of Dais

During 1987–90, CHETNA trained over 1000 Dais from the states of Gujarat, Rajasthan, Uttar Pradesh and Andhra Pradesh. This was done in collaboration with local NGOs who than took on the task of follow-up and monitoring. A general feedback of the training was given in terms of the following:

- Increased acceptability and credibility of Dais in the community
- Increased self-confidence and self-respect
- Utilizing positive traditional practices during pregnancy and labour, viz., birthing posture, herbal remedies' massage and so on.
- Adopting aseptic measures during labour, viz., scrubbing hands, cutting nails etc.
- Linking up with ANMs and health centres for care and referrals
- Addressing reproductive health problems of women and men

These experiences reflected three strong areas for intervention, viz.

1. Recognition of the Dai by the governmental healthcare system and integrating her with the primary healthcare system.
2. Understanding Dai practices from a positive viewpoint and strengthening her knowledge on the basis of traditional medical systems like Ayurveda.
3. Building capacities of trainers, supervisors and managers of health programmes to develop a positive approach towards the Dai tradition.

Training of trainers (TOT)

The capacities of 50 trainers were strengthened. These trainers then conducted Dai training programmes in their respective organizations. Efforts were also made to strengthen the capacities of government employed trainers so that they could implement an effective Dai training programme.

This strategy has enabled organizations and individuals to view Dais from a positive angle and integrate them in existing health programmes.

Long term linkages

Long-term involvement with organizations implementing the Dai training programme was forged and efforts were made to support and strengthen their activities. In Rajasthan, these include URMUL, Falaudi; Sewa Mandir, Udaipur; CUTS, Chittorgarh; Astha, Udaipur and CASA, Udaipur, and SARTHI, Godhra and DHRUV, Dharampur in Gujarat.

These efforts enabled appropriate implementation of Dai training programmes and strengthened NGOs abilities to train Dais for women's health and development.

Developing teaching aids

In order to support trainers imparting training to Dais, CHETNA has developed a multimedia training kit, which is useful to impart training to Dais, and it has been widely distributed.

Sharing and networking

CHETNA has been sharing its experiences of Dai training at various national and international forums and advocating for their recognition in healthcare systems, programmes and policies. Related reports and documents are shared extensively at the national and state levels with NGOs, academicians and GOs, and links have been established.

Advocacy efforts

CHETNA along with its partners is advocating for the recognition of the role of Dais in safe home births. This includes presentations and showcasing the Dai tradition at national and state level policy meetings, media advocacy, developing an advocacy paper and building capacities of community based organizations to implement evidence based Dai training programmes.

CHETNA is also advocating for safe home births at the international level through the People's Health Movement and in the South Asia region. A brief description of the efforts being made is discussed below:

1994–2000: Global environment changed focus from maternal and child health to maternal mortality, and the role of the Dai in childbirth was marginalized.

A state level meeting of civil society members was organized in the year 2000 where advocacy for the recognition of Dais was identified as something that needed to be done.

A Gujarat state level meeting of civil society members was held to plan the advocacy strategy for the recognition of Dais.

State and regional activities were organized in Gujarat to highlight the Dais' work.

On 11th April 2003, National Safe Motherhood Day, a Dai mela and consultation was organized in collaboration with the Government of Gujarat.

The state's Department of Health and Family Welfare reviewed the curriculum of the Dai training programme and recognized the Dais trained by three NGOs in Gujarat.

A state level task force was formed to look into Dai and safe motherhood issues.

A policy dialogue was organized by SUMA, Rajasthan White Ribbon Alliance on the Role of the Dai in safe home births at Jaipur on 14th November 2003.

At the National and International level

Presentations were made on recognition of Dais at the National and International People's Health Assembly in the year 2000.

Dais were provided a forum to share their experiences and concerns on their role in home births at a national consultation on safe home births organized by the White Ribbon Alliance, India (WRAI) in 2001.

Some Dais were given awards for their role in maternal and newborn healthcare during the International Conference on Saving Mother's Lives organized by WRAI in October 2003.

A national level dialogue was organized on the role of Dais in linking homes to hospitals, May 2004.

In July 2004, the Department of Health and Family Welfare called a meeting of civil society members to discuss Dai training in the state.

The state level task force has taken up the issue of organizing Dais, and a series of consultative meeting were held (August 2004–July 2005).

The Dai Association, Gujarat was launched on 11th April 2005 in the presence of 1500 Dais, the minister for health and officials of the Department of Health and Family Welfare.

The Dai Association, Gujarat was registered on 9th June 2005 as a legally registered charitable society.

The Dai Association has a membership of about 5000 Dais and 12 NGOs from the state of Gujarat, India. It was founded by seven Dais [#] and seven lead NGOs [§§] of Gujarat, India, who had been working on safe motherhood issues for more than a decade and a half. The president and vice president of the Dai Association are Dais themselves, and it was launched on 11th April 2005 (National Safe Motherhood Day) in a meeting with the Department of Health and Family Welfare, Government of Gujarat, and 1575 Dais from 15 districts of Gujarat.

The goal of the Dai Association is to work towards improved maternal and newborn health in the state of Gujarat. The objectives are to

- Organize Dais and to advocate for their recognition as a link between the community and the public health system;
- Work towards development of traditional midwifery standards and
- Enhance the capacities and skills of Dais.

Some of the critical outcomes of efforts made by the Dai Association, Gujarat are given below:

Advocacy for recognition of Dais

- A Government Resolution was issued (August 2005) and sent to all 25 District Health Officers of the state recognizing the role of the Dai in maternal and newborn health as well as in other national health programmes. The state has provided a copy of the same to the Dai Association (TAPW1020001076-GH).
- A state directive to the District Health Officers of Gujarat has been issued to provide remuneration to Dais: Rs.25 for normal deliveries and Rs.50 for referrals. The Department of Health and Family Welfare, Government of Gujarat, is considering giving this amount to the Dai Association for reimbursement to Dais (December 2005).

[#] Babiben (Dholka); Champaben (Jhagadia); Leelaben (Surendranagar); Vanitaben (Valsad); Ramilaben (Vadodara) Maliben (Panchmahal); Parvatiben (Radhanpur).

[§§] Bhansali Trust, Radhanpur; CHETNA, Ahmedabad; Deepak Charitable Trust, Vadodara; SEWA, Ahmedabad; SEWA Rural, Jhadagia; SARTHI, Panchmahal; SWATI, Surendranagar.

- The state has agreed to provide a matching grant to the core fund of Rs.1,05,000 (US$ 2400) that was contributed by board members of the Dai Association (November 2005).
- The state has agreed to provide Rs.2100 (US$ 46) from the total capacity building cost of Rs.5000 (approximately US$ 100) per Dai for capacity enhancement. Dai Sangathan has agreed to raise a matching grant (November 2005).
- The Department of Health and Family Welfare, Government of Gujarat, held a meeting with District Health Officers on 24th December 2005. The Dai Association was invited to discuss ways and means of strengthening co-ordination with the district health department. A common consensus was obtained, and the officers expressed their readiness to work with the Dai Association at the district level also. The Association meets the officers at regular intervals at the state level.
- UNICEF-Gujarat expressed willingness to support district level gatherings of Dais (Sept 2005).
- District level Dai Sammelans were organized during March–April 2006.

Efforts for enhancing capacities of Dais

- Capacity building of Dai trainers from 13 districts of Gujarat, India, was carried out on the basis of a comprehensive curriculum developed by the Dai Association (August 2005).
- Following this, the capacity enhancement training of Dais from Ahmedabad district of Gujarat has been initiated by the Dai Association, with financial support from the Department of Health and Family Welfare, Government of Gujarat (January 2006).
- A dialogue with the Department of Health and Family Welfare was held for recognition of Dai training by the seven founder members. The department has issued a directive to the District Health Officers regarding the same (November 2005).

Recommendations

Develop evidence on traditional midwifery

In the absence of appropriate local evidence, it is difficult to convince the scientific community about the importance of the Dai's role. There is a need for authentic research and evidence collection on the role of the Dai in childbirth.

Develop standards for traditional midwifery

While the tradition of home births by Dais operates informally, a need to develop midwifery standards for Dais is strongly felt. The National Institute of Health and Family welfare has been a pioneer in developing a curriculum for Dai training. Several NGOs have developed their own standards, curricula etc.

There is a need to review the existing efforts and, on the basis of the experiences, develop standards for traditional midwifery. The ISM and H (indigenous systems of medicine and homeopathy) department and Ayurvedic universities and institutions also need to be actively engaged in this process.

Enhance solidarity among existing Dais

At present, about six lakh Dais are working in isolation without any formal organization. There is a need to form Dai associations across regions. These associations can become platforms for building the capacities of Dais, regulating, standardizing and upgrading their professional skills and for advocacy.

Strengthen the Dais role in safe home births

The Dai tradition differs from place to place. Various training and follow-up efforts by NGOs have shown that through adequate training and follow-up, the Dais can become leaders of social change and can provide basic health services during pregnancy, childbirth and after childbirth as well as take care of the other socio-medical issues of women and adolescents.

The traditional role of the Dai needs to be expanded to include the health concerns of women and men as well as newborn care. Her acceptance in the community can be useful in allowing her to reach out to women in difficult situations, adolescent boys and girls and men in particular.

Ensure community support

While the Dai's role is critical for safe home births, because of her low status in the social class–caste order and her secondary status as a woman, she is often ill-treated and ignored by society. Being relegated to a secondary status, her own health is at times at stake. There is a need to support Dais in rural communities.

Public and private healthcare systems need to be sensitive to the social aspects of the Dai tradition and to recognize the fact that she is a member of the oppressed and disadvantaged section of society, which has been systematically marginalized. There is a need to provide community social support systems that will ensure social security and will create support groups and structures for the Dai.

Provide back-up services

It is evident in the existing scenario that unless Dais are involved it will not be possible to provide a trained person to attend normal deliveries. Hence, it is important that Dais are recognized and interwoven with the existing primary healthcare system and are actively involved in the PHC.

Trained Dais need to be supported by functional and effective public and private essential and emergency obstetric care services. Keeping the Dai as a central community service provider, special links need to be developed with the ANM, the Anganwadi worker (AWW) and the referral healthcare system.

Supervise the Dai's work

While Dais deftly manage home births, there is a need to supervise their work, particularly in remote, rural areas. This would enable monitoring of childbirth and correction of any discrepancies in the Dai's practice. In co-ordination with the AWW and the ANM, she should be made a part of this system.

Provide social security

Some of the measures that could be taken up to provide Dais with social security are given below:

- Making a local inventory of Dais and the women/men who want to take up this work
- Creating birthing homes for women
- Allocating land and resources for the cultivation of the herbs used by Dais
- Supporting Dais for referrals through training, support and supplies
- Displaying contact numbers and addresses of the doctors and referral centres as well as other related persons at a common community point
- Fixing up a standard remuneration system for Dais
- Providing Dais with social and health insurance

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Traditional Medicine and Food Today

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Abstract

Surrounded by the sea, Sri Lanka has 3 major climatic zones and nearly 24 minor climatic zones. The main cause for the rich and largely endemic biodiversity is the diverse climatic conditions. As a result of colonialism, many endemic flora and fauna were destroyed, vast areas of forest were opened for monocropping and many new varieties of flora were introduced to the country as commercial crops. The result of these practices was the gradual erosion of biodiversity. This was evident mostly in the central hills and the wet zone. But, the biodiversity of the dry zone still remains rich. During the colonial period, new food varieties were also introduced. These are called "English vegetables" even today.

During the old days, health conditions in the villages remained at a high standard because of the consumption of indigenous nutritional food and the use of indigenous medical practices. But, today, as a result of "modernization" most of the traditional food varieties are lost. Many varieties of local fruits are dying out.

Under the Compas indigenous knowledge revitalization programme, emphasis was placed on food that is eco-friendly, readily available and sustainable in its zone. The areas where traditional food practices are still prevalent in rural communities were selected for the study. Owing to modernization, traditional food and its preparation systems were undermined by modern society and in the media. However, there are some groups of people who still preserve the traditional methods related to food and food preparation.

Medicinal properties of food: In order to prevent and/or control certain diseases, indigenous medical practitioners introduced suitable additions and ingredients to food. When a patient sought treatment, indigenous medical practitioners educated them on the do's and dont's of food as well as on methods of preparation.

Surrounded by the sea, Sri Lanka has 3 main climatic zones and nearly 24 minor climatic zones. The main cause for the rich and largely endemic biodiversity is this diverse climatic condition. Many varieties of flora and fauna, which are endemic to each zone, are found on the Island.

British colonialism destroyed the biodiversity of the country. Vast areas of forest were opened for monocropping, and many new varieties of flora were introduced to the country as commercial crops. The result of these practices was the gradual erosion of the Island's biodiversity. This was evident mostly in the central hills and the wet zone.

But, this condition did not affect the dry zone much, and therefore, the biodiversity of the dry zone still remains rich. During the colonial period, new food varieties were also introduced. These are called "English vegetables" even today.

During the old days, health conditions in the villages remained at a high standard because of the consumption of indigenous nutritional food and the use of indigenous medical practices. The consumption of traditional indigenous food also served to prevent and cure many diseases like rheumatism and bile- and phlegm-

related disorders (*pitta* and *kapha*). At the same time, it conserved the forests and gardens.

But, today, as a result of "modernization" most of the traditional food varieties are lost. Many varieties of local fruits are dying out.

Under the indigenous knowledge revitalization programme supported by Compas, emphasis was placed on food that is eco-friendly, available and sustainable in its zone. The areas where traditional food practices are still prevalent in rural communities were selected for the study. Although traditional food and its preparation systems were undermined, by modern society and in the media owing to modernization, there are some groups of people who still preserve the traditional methods related to food and food preparation.

Medicinal properties of food

Indigenous medical practitioners introduced suitable additions and ingredients to food in order to prevent and/or control certain diseases. When a patient sought treatment, indigenous medical practitioners educated them on the do's and don'ts of food as well as on methods of preparation.

The objective of the study and documentation done by FIOH (Future In Our Hands) under the Compas programme was to revitalize the knowledge and practices related to traditional food culture with special emphasis on its medicinal qualities.
The focus here was on the following:

- Traditional dry zone villages in Uva province
- Food and its preparation at the rural level – different preparation methods and their rationale
- Medicinal properties of food and combinations as people perceived them
- Food varieties available locally for which the knowledge of their use was fast fading

The methods used for collection data

Data collection was carried out through the existing women's groups in the FIOH working area. A large number of recipes were collected from women. The criteria for selection of recipes were based on the endemic nature of the plant species used in the recipes and the lack of knowledge about such items among people in general.
The collected information was categorized into the following:

- Herbs used for food and food preparations
- Food used for recovery – after illnesses, childbirth etc.
- Food used for prenatal and post-natal care
- Food preparation during cultural festivities

Validation

Once the information was collected, the data was discussed among other groups and additions and deletions were made. As the food recipes that were described are ones

that are being used now, it was only a matter of clarifying the preparation methods and discussing their value as medicine.

The food recipes and their medicinal values were discussed with Ayurvedic and local health practitioners. The information on medicinal value was revised accordingly.

Presentation and popularization

The information gathered was presented in a booklet for the benefit of the people who would use it as resource book. The information is organized in the following format:

1. Popular name of the food item
2. Botanical name
3. Nutritional value
4. Usage: food/curry etc.
5. Beverage

The following actions were taken to popularize traditional food among people.

1. Organizing food fairs and competitions
2. Holding workshops and discussions on food values and preparation
3. Putting on street dramas
4. Distributing plants in order to help people conserve and use them

Conflict, Coexistence and Translation: The Question of Innovation in Contemporary Traditional Medicine [Ψ]

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Abstract

This paper attempts to address a seeming oxymoron: how do innovations occur in the realm of the traditional? Is tradition antithetical to innovation? If innovation occurs in the traditional is it an act of mimicry: an act that occurs only in the shadow if its encounter with the modern. For example, does the modern college of traditional medicine mimic the modern teaching hospital in its architecture, its pedagogy, its syllabus and, finally, in its very conceptual content? Is this also true for the process of manufacturing traditional drugs? Does it again mimic the biomedical pharmaceutical industry both in its form and concept?

The theme of innovation has recently been addressed in the context of Chinese medicine and also broached by Obeyesekere in the context of Ayurveda under the notion of "samyogic experimentation". Obeyesekere and the contributors to Hsu's volume primarily address the issue with respect to clinical, diagnostic and literary practice. Amongst these contributions, this paper hopes to address, through a series of case studies, innovations in traditional medicine at two different sites: the pharmaceutical and the clinical. In the bargain, it hopes to problematize the notion of innovation and, at the same time, examine some of the issues that confront both clinical practice and pharmaceuticals in contemporary Ayurvedic medicine.

[Ψ] The full text of these papers are currently not available and hence the abstract alone has been presented here.

Discussion on Policy Issues Working in Smaller Groups

Group discussions

During the post lunch period, it was decided that the participants would be split into four groups. Each of the groups would deliberate on a given topic, and the four groups would hold their discussions simultaneously. Following this, all the groups would meet in a plenary session to present their conclusions for mutual review and discussion.

Given below is the summary of the presentations by each of the four groups.

Group I - University teaching and research

The members of the group were Dr. Veena Ganeshaiah, Dr. M. N. B. Nair, Dr. P. R. Kanani, Mr. Coen Reijntjes, Prof. T. T. Ranganathan, Mr. Aruna Kumara, Prof. Nimal De Silva, Prof. Sarat Bhandara, Mr. Darshan Shankar, Ms. R. Sridevi, Mr. Viswanath and Mr. Lokesh.

Summary

1. What can we do about this?

1. Create awareness of IK among faculty staff
2. Initiate development of curricula to strengthen and protect the principles of IK
3. Influence policy makers of secondary education to introduce "heritage studies" to school curricula.
4. Motivate and give incentives for research as fellowships etc.
5. Promote postgraduate research that is directly applicable to the farming community

2. How to do it?

1. Revitalize (or decolonize) IK by preparing material in local language
2. Carry out comparative studies between the concepts of modern agriculture and those of IK
3. Improve interaction with local people

3. Pitfalls and prospects

1. We might end up distorting the sciences rather than strengthening them.
2. Overcome constraints by integrated technology

4. Problems of meeting expected standards

1. We need a correct management regime.
2. We need to prioritize rapid access to technology.

Group II - Generation and validation of traditional knowledge

The members of the group were Dr. Harish Naraindas, Mr. K. A. J. Kahandawa, Mr. Bertus Haverkort, Mr. Anand Kumar, Dr. P. M. Unnikrishnan, Mr. Deepak and Ms. Malkanthi.

This committee had great difficulty in coming to any kind of consensus about a future course of action. It began by acknowledging that all traditional knowledge (TK) currently seemed to be in the doldrums. It than posed the question: "For whom was it in the doldrums"? Was it for its producers and everyday users or was it for people like us who were not its producers and could perhaps be its users or could want to be its users. The "us" included the committee itself and people of the same social class, and by social class, it could be meant those who had been trained in a university with "universal" premises about the world and ostensibly universal principles and laws!

In the light of these universal principles/laws etc., TK was local, alternative, non-rational, spiritual etc. Hence, these local, non-universal traditions had to be reinvented by validation, validation by universal science. In this act of validation, it was presumed that there were the following kinds of stakeholders.

1. Universal scientists
2. Local knowledge producers
3. Universal users
4. Local users
5. The state
6. The market
7. NGOs

The debate then turned to their possible conflicting interests, and whether TK could be generated, tested, validated and transmitted on its own terms and by its own institutions. It was also acknowledged that TK was currently in a marginal position vis-à-vis universal knowledge (UK) and that Compas and the current gathering was a symptom of this marginality and the increasing involvement of Compas-like organizations worldwide to engage with them. The debate then moved to how TK could be "revived", "preserved" and perhaps "resituated". Was the university based on universal principles a good or a bad thing should and could shamanism, for example, be taught in universities? Should and could we move from a university to the pluriversity? Was this to be a strictly secular or non-secular institution? Who would benefit from the pluriversity, with its new forms of knowledge? Was TK only to be the object of study in a pluriversty as it is in universities or also a subject of study with its faculty and students?

Meanwhile, it was pointed out that TK "mediated" and "revived", by NGOs for example, could be of use to its own producers and users. A very nice example of this was the Sri Lankan story of the coming together of snakebite healers with their respective textual sources. It was seen as a moment of mutual reckoning, comparing of practices with the theory in the texts and, at times, of correcting a word or verse in some of these texts in the light of the other texts.

This group ran out of time and could not conclusively say anything about how TK was indeed generated and validated, nor could it make any concrete suggestions

about the future endogenous development of TK, either aided or unaided by exogenous factors, except for generally agreeing that endogenous development was indeed desirable without knowing what it was exactly, how it was to be achieved, facilitated or institutionalized. Nor was the group entirely sure who would benefit although it was quite sure that it ought primarily to benefit its producers.

Group III – Upscaling and translating endogenous development (ED) into action

The members of the group were Mr. Hari, Mr. Nimal Hewanila, Mr. Jayasinghe, Mr. Gowtham Shankar and Ms. Arthanayaki.

Upscaling and Translating Endogenous Development into Action

S. NO	ASPECTS	WHY	WHAT	WHO	WHEN	WHERE	HOW
	Upscaling / Enriching / Expanding	Societal Impact on a Scale, To Empower, Deepen, Quality, Quantity, In Order To Advocate Policy Changes	Outcomes of Action Research Pilot Experiments Of E.D Under Various Themes	Stake –Holders, CBOs, Facilitators, Research Institutions, NGOs	Post Project	Across Regions In A Viable Extent, I.E., Block , Taluk,District	Participatory-Implemented By Stakeholders, Facilitated by CBOs,NGOs, Supported By Res.Instns.,With Resources From GOs, NGOs.
1	Upscaling / Enriching / Expanding	Societal Impact on a Scale, To Empower, Deepen, Quality, Quantity, In Order To Advocate Policy Changes	Outcomes of Action Research Pilot Experiments Of E.D Under Various Themes	Stake –Holders, CBOs, Facilitators, Research Institutions, NGOs	Post Project	Across Regions In A Viable Extent, I.E., Block , Taluk,District	Newsletters, Forum,Meetings, Workshops , Etc.
2	Upscaling / Enriching / Expanding	Societal Impact on a Scale, To Empower, Deepen, Quality, Quantity, In Order To Advocate Policy Changes	Outcomes of Action Research Pilot Experiments Of E.D Under Various Themes	Stake –Holders, CBOs, Facilitators, Research Institutions, NGOs	Post Project	Across Regions In A Viable Extent, I.E., Block , Taluk,District	Field Visits, Meetings.

Group IV – Advocacy forum

The members of the group were Dr. Rama Jayasundar, Vaidya Smita Bajpai and Mr. A. V. Balasubramanian.

The major objective of the advocacy forum would be to carry out its advocacy efforts to target people from a wide cross-section of society including policy makers, media, scientists, bureaucrats, elected representatives of the people, professionals in the modern stream such as allopathic physicians and national as well as international donor agencies. The objective of this advocacy forum would be to influence the manner in which policies are made or implemented.

Outputs

The following are the kind of outputs that will be produced by the advocacy group: –

- Policy papers and notes
- Production of fact sheets and critiques of existing policies and their implementation
- Sending delegations and teams for visits to institutions and forums of policy makers
- Legal steps and interventions where required

Organizing advocacy

The group identified the following as some of the important steps in organizing advocacy:

- Listing of critical issues that need to be targeted for advocacy work. In this exercise, this group would rely upon members of the other three groups for their inputs.
- Identifying persons who and institutions and forces that are for the advocacy efforts, against it or are neutral.
- Initiating and targeting action both at the national as well as the international level.

Getting started

The following are identified as some of the immediate steps to be taken:

1. Circulation of a note identifying the need for advocacy. Setting an agenda identifying the objectives in terms of what needs to be done.
2. Defining membership of the advocacy forum, a method for co-ordination and a mechanism for extension of membership
3. Convening a larger meeting with the objective of evolving a work plan for identifying issues, constituting committees around specific issues (such as education, research etc.) and constituting groups around particular sectors (agriculture, health etc.).

Is There an Indian Way of Doing Science?

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Abstract

In the last twenty years, there has been a sharp and significant rise in interest and work on various aspects of traditional knowledge systems the world over and particularly in India and other parts of Asia. It is now widely recognized that traditional knowledge has much to offer that is of great value in varied areas particularly medicine and agriculture, to name just two specific areas. However, the comprehension of the nature of traditional knowledge in totality continues to be an area where there are a lot of differences and divergences of viewpoints. As per the "classical viewpoint" that has its origins in the later part of the colonial period, it was considered that what goes by the name of traditional knowledge in most areas has the following features

- *It is a collection of recipes or empirical knowledge.*
- *It is often found to be a mixture of observations and interesting information about the use of bio-resources coexisting with an enormous amount of superstition, mumbo-jumbo and wholly incorrect or imprecise information and observations.*

In order to make sense out of traditional knowledge and "separate the wheat from the chaff", one needs to make an examination and assessment of all the aspects of traditional knowledge using modern scientific research methodology, and this would help us assess what is worthwhile and valuable in traditional knowledge.

However, there has also been a distinctly different view and perception of traditional knowledge that has existed for a long time and that is slowly gaining increasing voice and ascendancy in the last few years. Some of the features of this viewpoint are

- *Traditional Indian knowledge is not merely a collection of recipes but an entire knowledge system in itself.*
- *Underlying this knowledge system is a set of values and a world-view that is drawn from the culture, civilization and the geographical location where this knowledge originated.*
- *Traditional knowledge has its own methods and criteria in terms of how knowledge is generated, validated and propagated.*

In this presentation, I will make an attempt to provide an introduction to the nature of traditional knowledge and highlight what I consider to be some of its basic features, focusing on the following:

- *The type and nature of parameters with which theories are made in traditional knowledge.*
- *Some of the important aspects in which traditional knowledge has a viewpoint that is different from what is accepted in modern western scientific methodology such as the idea of measurement, the idea of controlled experiments etc.*
- *The necessity and importance of comprehending traditional knowledge as an entire knowledge system.*

I believe that currently we are not in a position to provide a detailed and comprehensive description of the nature of traditional knowledge, but it is still worthwhile to explore and comprehend at least some

aspects of traditional knowledge systems as outlined above. This presentation will make a beginning in this direction.

"Is there an Indian way of thinking?" – this fascinating and provoking question was raised for the first time by A. K. Ramanujan in an essay that he wrote bearing the same title (Ramanujam, 1989). He pointed out that the question in a way contains within itself several other questions that may arise depending on the precise word on which we place the emphasis when the question is posed – a few examples are given below:

- *Is* there an Indian way of thinking?
- Is there *an* Indian way of thinking?
- Is there an *Indian* way of thinking?
- Is there an Indian way of *thinking*?

In the context of our own interest in traditional sciences and technologies, this question is of central importance. It, in fact, may be considered as a metaquestion that arises from our concern about "Is there an Indian way of doing science". One might be wondering whether it is merely a popular preoccupation of some philosophers of sciences to raise such a question. The concerns of philosophers of sciences/scientific philosophers have always been viewed with a great deal of suspicion by many working scientists. In fact, Steven Weinberg has been attributed with the caustic remark "philosophy of science is about as useful to scientists as ornithology is to birds" (according to some other sources, the author of the remark is Richard Feynman).

Nevertheless, from our own viewpoint, I feel that there is indeed a need to answer this particular question for the following reasons:

- To understand the cultural, geographic and civilizational specificities of knowledge
- To better understand and utilize traditional Indian knowledge
- As protection against "epistemic fascism"

In any scientific discourse, it is essential to achieve precision and rigour. In the western tradition, the geometry of Euclid is considered the paradigm of an ideal theory, and various other branches of knowledge tried to emulate Euclid by setting out their knowledge on the basis of a formal axiomatic system. In contrast, in Indian tradition, an attempt was made to use natural language and to refine and sharpen its potential by technical operations so that precise discourse was possible even in natural language. This is so, particularly in Sanskrit, where we find that even the most abstract and metaphysical discussions regarding grammar, mathematics or logic are still written in natural language. In Indian knowledge systems, it is the science of linguistics that occupies the central place that, in the west, is occupied by mathematics. Hence, traditional sciences have a different approach to achieving rigour.

One way of addressing this issue is to look at some specific aspects of traditional sciences and technologies and compare them with the approach or viewpoint of modern sciences and technologies in the very same areas. In this presentation, I would like to take a look at the following three aspects in such a comparative framework.

- Social organization of knowledge
- Parameters used to construct theories
- Some features of scientific method and approach

The social organization of indigenous health traditions

The Indian sub-continent abounds, as it were, in a variety and diversity of health traditions. We have with us what is perhaps the longest unbroken health tradition, which has not only a stream of practitioners but has also a textual and theoretical backing in terms of the Ayurvedic and Siddha systems of medicine (Balasubramanian and Radhika, 1989). They have made their presence felt even outside India, in other parts of Asia such as China, Thailand, Cambodia and Indonesia. However, what is most remarkable about the Indian medical tradition is that it prevails at two different levels, namely, the classical system and the folk system. By the classical system, I refer to the codified systems such as the Ayurveda, Siddha and Unani traditions. They are characterized by institutionally trained practitioners, a body of texts and highly developed theories to support their practices. As against this, we also have a folk tradition (or what may be termed as the *Lok Parampara*) that is an oral tradition passed on from father to son or mother to daughter (or daughter-in-law) or from *guru* to *sishya* in tens and thousands of our villages through the ages. These folk traditions are rich and diverse, as the following list illustrates, and include several practitioners.

- Home remedies and cures for common ailments
- Hundreds of thousands of folk and tribal practitioners known as *Vaidus, Nattu Vaidhyars, Bhagats* who learn through oral traditions and who treat a variety of ailments
- Knowledge and beliefs regarding foods – *Pathyam* and *Apathyam*, i.e., foods to be preferred or avoided during specific diseases or conditions such as pregnancy, by lactating mothers etc.
- Folklore on health (e.g. proverbs relating to health)
- Individuals/families specializing in the treatment of specific diseases e.g. jaundice, asthma
- Knowledge of diagnostic procedures
- Knowledge of preventive measures
- Knowledge of *Rutucharya* or adaptation of food and regimen to suit the seasons
- Yoga and other physical cultural practices of a preventive and promotive nature
- Special areas such as bonesetting, *visha chikitsa* (treatment for poisons), *Panchakarma* (five purificatory procedures) etc.
- Over 600,000 Dais (Traditional Birth Attendants) who perform home deliveries

The relationship between folk and classical traditions is found to be symbiotic. There is a strong commonality of underlying theory and world-view expressed at the level of *Panchamahabhoota* – theory of composition of matter – and *Tridosha* – theory of causation of disease. There is also a striking common ground between the technical terms that are used by the expert practitioners and what is known to the folk

practitioners. The technical vocabulary such as *vaata, pitta, kapha, ushna, sheeta, laghu, guru, guna, veerya* etc. are also very much part of the knowledge of folk practitioners and common households.

It is also interesting to see what the classical texts of Ayurveda say about folk tradition. The *Charaka-Samhitha* states that " *Oushadihi naama roopabhyaam, jananthe hyajapaa vane, avipaashchaiva gopaashcha ye cha Anye vanavaasinaha*" – "the goatherds, shepherds, cowherds and other forest dwellers know the drugs by name and form…". Similarly *Susrutha-Samhitha* states that "*Gopaalasthaapasaa vyaadha ye chaanye Vana charinaha, Moola jaathihi cha tebhyo Bheshaja vyakthi Ishyathe* – " one can know about drugs from the cowherds, *thapasvis*, hunters, those who live in the forest and those who live by eating roots and tubers".

Folk traditions today

In the 1980s, the Ministry of Environment and Forests of the Government of India initiated an "All India Coordinated Research Project on Ethnobiology" with the objective of carrying out a detailed assessment of the knowledge and use of natural resources by the tribal communities of India. The mid-term report of this programme, which was published in 1994, indicated that these communities have knowledge of about 9500 species of plants of which the single largest use category is medicinal plants accounting for over 7500 species (MoEF, 1994). This should be seen in the light of the fact that in the classical systems of medicine it has been estimated that totally only about 900 species of medicinal plants have been referred to in the three major texts of Ayurveda. Hence, this is a truly stupendous number by any standard. We should also assess the information in the light of the fact that tribals constitute only about 7% of the total Indian population, even though they are perhaps a section of the population that lives most closely in communion with nature.

Parameters used to build scientific theories

It is widely believed and expressed that traditional science in India has not developed over the last few centuries and that it has stagnated. As per one view, this has happened because of the disruption and disorganization of Indian society during the colonial period, but as per yet another popular view, it is considered that there is an intrinsic problem with Indian society and thinking that makes our knowledge repetitive and stale and that accepts authoritative pronouncements of masters and sages unquestioningly. What is seen as a manifestation of this tendency is the apparent constancy and lack of change of the basic theories with which traditional sciences tend to explain anything – for example, the traditional theory of the composition of matter or cause of disease is believed to have remained more or less unchanged for a couple of millennia. This is in direct contrast with modern scientific theories, which on the face of it show dramatic change and improvement. Early in the last century, Captain G. Srinivasamurthy, a modern trained physician who undertook a deep study of the traditional knowledge of medicine, used an interesting analogy to understand this (Srinivasamurthy, 1986).

The subject of aetiology provides us with a striking illustration of this characteristic feature of Indian analytical thought. That causation of diseases is by agencies outside of oneself is the common ground between the aetiology of both Ayurveda and allopathy shows the characteristic features differentiating the two viewpoints. An analogy may perhaps serve a useful purpose in this context. Let us suppose we wish to classify the various invasions of India; we may do it in two ways: in one, we may classify the invasions as those by either land or sea or air; in the other, we may classify them as those by the Greeks, the Scythians, the Mohammedans, the Europeans and so on. The first classification is all-comprehensive and applicable for all time because all invasions must take place in one or another of these three modes – singly or combined. This is equivalent to the Ayurvedic view where all disease is classified and understood as being due to the imbalance of *vata, pitta* or *kapha* – recognized by the symptoms of the patient. But, the second classification is applicable only to the present and the past and, that too, only so far as it is known, and if there are new invasions in the future by people other than those given above, the list will have to be added to, whereas, in the first cast, all future invasions will naturally go in under one or other of the three categories that have been laid down once for all and for all times as it were.

Thus, we can see that even new conditions and diseases can indeed be dealt with by Ayurveda within the traditional framework because of the nature of the parameters that are used to build their theories. I was present at a fascinating discussion in the 1990s where a modern Ayurvedic physician from Pune analyzed "blood cancer" in a patient using Ayurvedic theories a couple of millennia old and identified it to be "*vata* afflicting the *astha* and *majja* tissues and severe depletion of *dhatus*".

Measurement and quantification: achieving rigour

Assigning numerical values and making precise measurements is indeed a hallmark of the modern scientific method not only in the physical sciences but also increasingly in the biological and even social sciences. It is sometimes felt that traditional sciences are not up to the mark since we see no precise measurement of quantities in this sense.

Measurement and quantification are indeed present in our traditional sciences though they occur in a manner that is somewhat different from the modern notion of the matter. Most measurements in traditional medicine are by using units that are normalized to a given individual. For example, this means that while measuring the height of a person's body or the length of his limbs, they are expressed in units of *Anguli* – that is, the dimension of a finger of the same person rather than an arbitrary standard external to the individual like the standard international metre. In fact, such normalized units exist for measurements of not only length but also volume and even for the measurement of time. In Yoga, a unit of time has been defined that is normalized to the individual. In *Yoga Cintamani*, a *Maatra* of time has been defined as the time taken by an individual who is asleep to complete one cycle of breath, namely, one inhalation and one exhalation.

Scientific theories and how they are built

A few years ago, at the Centre for Indian Knowledge Systems, we had a fascinating experience on the basis of which we had to delve into this matter in some detail. As per the insight and understanding that we have from Vrkshayurveda (traditional Indian plant Science), plant products that have a particular *rasa* (taste) such as a bitter taste or specific types of smells are excellent candidates for having biological control properties that may be effective against pests. We put this to practice in a very effective manner when we found that the leaves and stem of the plant *Andrographis paniculata* (known in Sanskrit as *Bhunimba*), which is extremely bitter in taste, were found to have excellent pest control properties. However, we realized that a statement such as how the smell or taste of a plant can give a clue to its biological properties is viewed with a great deal of discomfort and probably considered as mumbo-jumbo or nonsense to those who are trained in modern scientific methods. It was necessary for us to delve into the roots of such thinking – from where we did derive the idea that scientific theories or discourses cannot be carried out using parameters such as smell or taste. The answer to this question took us as far back as Aristotle in the history of western scientific method. I have quoted in this section extensively from a fascinating paper by Singh (2000) who has looked into this.

As a founding act of scientific method, Aristotle made an epoch-making distinction between trustworthy and untrustworthy qualities. Trustworthy qualities are those that can be grasped and cross-corroborated through more than one sense organ like shape, size, number etc., which for instance can be grasped by the sense organ of vision as well as that of touch. Untrustworthy qualities are those that can be grasped by only one sense organ and cannot be corroborated by another sense organ. Warding off "untrustworthy" qualities in the quest for knowledge is one of the cornerstones of scientific method (Aristotle, 1961).

Galileo Galilee gave finishing touches to the founding principles of scientific method and their consequent power. Galilee opened another new argument in favour of the distinction between primary and secondary qualities when he voiced, somewhat dramatically, a contemporaneously shocking sentiment, by saying there is more in common between the weight of an apple and the weight of the moon than between the weight of an apple and the colour of the apple. What he noticed was a new clinching argument, which was based on the relationship between measurement, primary and secondary qualities. Secondary qualities cannot be measured simply and they cannot be determinably related to each other, whereas primary qualities can be determinably related to each other. The primary qualities of objects can all be measured but their secondary qualities cannot be (Galilee, 1916).

How was this viewed in Indian tradition? Let us take a look at how the *Nyaya-Vaiseshika* School of India addressed this issue. Prasastapada had distinguished three classes of qualities that are grasped by the sense organs (Bhatti, 1997).

1. Those that can be acquired through two sense organs – number, magnitude, distinctness, conjunction, separation, farness, nearness, instrumental fluidity, attraction and speed.
2. Those that can only be acquired through one sense organ – sound, touch, colour, taste and smell.

3. Those that can only be acquired through the internal sense organ *manas* – cognition, contentment, discontentment, desire, aversion and effort.

All these three classes of qualities are trustworthy qualities that present themselves to elementary experience. Error and falsehood regarding knowledge of qualities are important issues, and **according to Prasastapada, they need to be understood independently and not in relation with the basic sensory mode of acquisition of qualities**. Aristotle not only overlooks the third class of qualities altogether but also relates trustworthiness with corroboration through more than one sense organ, a feature of the first class of qualities.

Dialogue between scientific traditions: current limitations

The current status of interaction between the two scientific traditions in India – traditional and modern – suffers from several limitations. In a broad sense, some of these are the result of the colonial hangover. Here, I would like to look at just two aspects of this interaction, namely, the limitation of the overall approach to studying traditional knowledge in the form of "prospecting" traditional knowledge and the assumed universality and neutrality of the methodology of modern science.

"Prospecting" traditional knowledge

Research on traditional knowledge by scientists from "mainstream" western science and technology institutions is not a new phenomenon. A lot of this research, however, suffers from the limitations of a mind set that essentially looks upon physical resources, as well as the technologies and knowledge of the local communities, as raw material that needs to be scanned, prospected and refined in order to get incorporated into the modern/western framework. Over the past centuries, a large number of herbs have been screened in this way for their potential pharmacological action, leading to some outstanding success stories, such as quinine from the Cinchona bark. At the same time, many perceive that these research activities do not lead to the revitalization of traditional knowledge or to the endogenous development of the communities involved.

Take for example, the case of the *Rauvolfia species*. *Rauvolfia serpentina* is a plant known in Ayurveda for a very long time. This small shrub used to be widely distributed throughout India, reputed for its medical potential in treating hypertension, fever, wounds, insomnia, epilepsy and certain conditions of *kapha* and *vatha* disorders. At the beginning of the 20th century, modern research was carried out on this plant, and the "crude drug" was fractionated into "active ingredients". One of these ingredients, the alkaloid reserpene, was identified as a powerful drug for hypertension. Subsequently, the drug based on reserpene was found to have several undesirable side effects, which were not present in the original formulation of *Rauvolfia serpentina* used in traditional medicine. Meanwhile, the research and use of the plant did not lead to strengthening of the traditional knowledge of the subject while the industrial demand resulted in over-exploitation of the plant in the wild. In fact, *Rauvolfia serpentina*, once growing abundantly throughout India, is today on the list of endangered species, and traditional medical practitioners are unable to get sufficient supplies for local use. Similar cases of modern research of traditional herbal medicine

have led to patenting of the knowledge and violations of the intellectual property rights of the original carriers of the knowledge.

Methodology of modern science: is it universal and neutral?

Yet another factor that has characterized the interaction between the two traditions is the confusing picture regarding the methodology of modern science. It is generally assumed that the methodology employed by modern science is universal in the sense that it is applicable to all cultures and scientific traditions and that it is neutral in the sense that it can be used to assess or evaluate the validity of any scientific tradition. However, this is quite deceptive since a closer examination of the elements of modern scientific methodology shows that quite often they may carry within themselves the stamp of their origin and that underlying this methodology may indeed be presuppositions and assumptions that are specific to modern scientific tradition. Let us take for example the modern scientific method of drug assessment by employing blind trials, double blind trials and placebos.

In modern testing procedures, only one group of patients receives the new drug, while the others are given a "placebo". But what if were dealing with a medical system where the patient is not just a passive recipient of a treatment but is an active participant in the therapy? If a patient is treated by an Ayurvedic physician, he may not only be prescribed a drug but is also given advice about how to regulate his diet – to avoid certain foods or methods of preparations – and may be given specific behavioural guidelines, such as the timing of meals, the spacing between meals, or sleeping habits. This difference is even more striking if a patient is being treated by the system of Yoga, which implies the active participation of the patient by performing certain *asana*s (assuming specific postures) or *pranayam*a (regulated breathing). In such cases, it is impossible to "blind" the patient. Hence, it appears that the system of performing blind or double blind trials is, in fact, a product of the cultural context in which the patient is the passive recipient of treatment. Therefore, we need to re-examine the assumptions behind the various methodologies of research and determine the methods that are suitable for a specific knowledge system.

Today's situation: signs of hope

In conclusion, I would like to spell out a few aspects of today's situation that I believe are cause for optimism.

Folk traditions today: creativity at the grass roots

There is every reason to believe that on the ground today, folk traditions are widespread in all areas and in various walks of life and are vibrant. There is every indication that they are showing dynamism and continuing to develop. Several examples can be seen all around of the active use of not only natural products but also t new synthetic products for a variety of purposes. A remarkable instance of the use of an exotic species by the tribal has been documented by Periera (2000). In the 1980s, the Forest Department had started to introduce the species *Acacia auriculaeformis* to the rural areas of Maharashtra. The seeds of these exotic species were first introduced in the area of the *Warli* Adivasis around 1985. It was observed as early as

1987 that the *Warlis* were catching fish by stupefying them with the seeds of *Acacia*. It takes about two years for *Acacia* to flower and fruit and the Adivasis' research had indeed been carried out very quickly. What makes this achievement truly remarkable is that there was no record as of that time of the use of the seeds of *Acacia* for this purpose either in modern literature or in the traditional folklore of Australia, which is the place of its origin. It is a remarkable testimony to the keen sense of observation and creativity at the grass roots. Many such examples can be given.

Synergy between multiple traditions

In retrospect, we can see that through the ages, every geographical location of the world has nurtured and produced sciences and technologies that bear the distinct stamp and character of its own people and civilization. However, during the last few hundred years and increasingly for a hundred years or so, a myth has developed to the effect that the western tradition of science and technology is unique and universal. This viewpoint has not only been propagated by the mainstream scientists in the west but has also been internalized by professionals in various other parts of the world, particularly developing countries. While it is true that in the west there is scholarship that points to multiple traditions of sciences and technologies, most often, this literature and discussions are confined only to theoreticians and professionals working in the frontiers of philosophy or epistemology of science. Meanwhile, this has not influenced the thinking of mainstream scientists, policy makers and others in any significant way. Therefore, there is an urgent need for new initiatives and paradigms of development with a balanced view on traditional sciences, technologies and knowledge systems. While modern science and technology has limited its benefits to a minority of people, the vast majority of the people in the world still survive on the material and intellectual sustenance of their own indigenous traditions. The activities of the Compas partners in India and other parts of Asia may be considered a contribution to this re-evaluation of indigenous traditions of sciences and technologies.

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Research in Ayurveda

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Abstract

Not withstanding the fact that there is an increased interest in the Ayurvedic system of medicine throughout the world, a series of questions are being raised regarding the scientific basis of the system, standardization of its medicines, the ability of Ayurvedic physicians to talk the language of current day scientists and the doctors trained in western medicine etc. Terms such as scientific rigour, objectivity, scientific evaluation, transparency, rational approach and clinical trials are used in almost all the meetings on traditional medicinal systems. A tremendous amount of national and international funding is available for research in traditional medicines. There are a number of groups –- allopathic doctors, chemists, biochemists, pharmacologists, engineers, biologists etc. – availing these funds and working on various aspects of scientific validation and standardization of Ayurvedic treatment and drugs. Considering the fact that Ayurveda understands the human body and treats diseases from a perspective different to that of western science, one has to look very carefully at the question of scientific validation and extreme care has to be taken to choose the appropriate experimental and clinical models. In this complex scenario, the challenge lies in setting the standards and addressing the right questions. If done with ingenuity, the results can be very rewarding. Does the current scenario in Ayurvedic research address the above concerns? This aspect will be discussed in this paper.

The turning of an increasingly chemicals-weary population towards natural products has renewed interest in plant-based drugs. Though not completely true, the general perception is that herbal products are safe and free from side effects. The holistic approach to health problems is another reason for the revival of interest in indigenous systems of medicine like Ayurveda. Not withstanding this increased interest, a series of questions is being raised about the scientific basis of the system, standardization of the medicines, use of modern parameters to define Ayurvedic parameters etc. The need for objectivity, a scientific evaluation, a rational approach and clinical trials are discussed in almost all meetings on traditional medicinal systems.

Ayurveda is the distilled core of knowledge obtained after years of trial and experimentation. Hence, it is important for anyone interested in research in Ayurveda to understand the principles behind it and the rationale behind the methods of diagnosis, treatment, preparation of its medicines etc. Since the bulk of the research is carried out by scientists who are not trained in Ayurveda, caution has to be exercised to make sure that the research is a fruitful one for Ayurveda.

Conventional medical research is always driven by problem identification and the demands made by allopathic doctors. These are often patient or treatment specific questions. Scientists from different disciplines such as chemistry, physics, engineering, biochemistry, pharmacology, mathematics, biology etc. work in unison to address the

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questions put forth by the medical fraternity. Since research in Ayurveda is being carried out along the lines of allopathic medicine and science, it would be interesting to see whether a similar situation exists in the case of current Ayurvedic research. In other words, is the scientific research in Ayurveda carried out in response to the queries and demands put forth by Ayurvedic physicians? The answer is sadly a "no".

Just as research in allopathic medicine takes the system forward and helps in its advance, research in Ayurveda should also help in the development of the system and in taking it forward. Let us look at some of the problems studied by the researchers of Ayurveda. They are standardization and quality control of drugs, correlation with modern parameters, toxicity studies, finding active ingredients and developing new herbal medicines. Most of these topics have got nothing to do with Ayurveda, especially the last one.

The development of new herbal medicines, apart from helping pharmaceutical industries, is used to further strengthen the allopathic system. These herbal medicines are not Ayurvedic medicines and hence are used by allopathic doctors and not by Ayurvedic physicians. Only medicines prepared as per Ayurvedic pharmacology and principles can be called Ayurvedic medicines. As for the standardization and quality control of Ayurvedic medicines, these cannot really be called research topics in the true sense. These are present day necessities.

Research in Ayurveda should be categorized into two aspects. One is to improve the science, and the demand for this should come from the Ayurvedic community. Some of the research problems of interest to Ayurvedic physicians are Ayurvedic pharmacological properties of new plants, new formulations with new plant entities, Ayurvedic nutritional properties of new food materials and items, looking into the possibility of how to use present day diagnostic techniques for Ayurveda. The second aspect of Ayurvedic research is due to present day compulsions, and under this would come studies such as quality control of drugs, clinical trials, documentation, studies on metallic preparations and toxicity studies of these drugs.

Looking at the question of quality control of Ayurvedic drugs, while this is very important, one has to very carefully look at how to carry it out and extreme care should be taken to select the experimental and clinical models. The parameters chosen for evaluation should reflect the essence of Ayurveda. For example, there are a number of functional parameters in Ayurveda, such as *deepana*, *pachana*, *samshodhana*, *samshamana*, *anulomana* etc. used to understand the pharmacological action of Ayurvedic drugs. It would therefore be more appropriate to use these in evaluating the quality of Ayurvedic drugs that are prepared according to Ayurvedic principles and methods. These methods are very different to how allopathic medicines are prepared. It is very important, therefore, to use the right methods and parameters to arrive at fruitful results. The challenge lies in choosing the appropriate experimental and clinical models and addressing the right questions. Great ingenuity would be required in the design of these studies, and if done properly, the results could be very rewarding.

Methodological Rigour in Knowledge Building – Ayurveda and the Scientific Challenge

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Abstract

This paper proposes to examine the position of Ayurveda as a knowledge system and to evaluate the rigour of the methodology it employs to build knowledge for effective application in healthcare situations. The discussion will be developed against the backdrop of specific criteria to distinguish between a belief system, a knowledge system and a science. The major point of focus will be the status of Ayurveda as a knowledge system and the convergence and divergence of its methodologies with that of "science" as it is understood today. In the process, an attempt will be made to create a coherent outline of the epistemological principles on which the body of Ayurvedic knowledge has been erected. The discourse will aim to highlight the contours and nuances of the thought process that characterizes the Ayurvedic approach to knowledge building, with supporting references from the source texts.

The preamble

Is Ayurveda an old system of thought based on ancient Hindu and Persian beliefs (Anonymous, 2005)? Does it need to borrow the methods of science to resurrect itself as a respectable system of medicine in the modern world? Such and other analogous questions daunt one's mind as one watches the resurgence of this age-old medical tradition of India in the global scenario under the umbrella term CAM – Complementary and Alternative Medicine.

There is a need for alternatives to scientific medicine, it seems, which is increasingly being complemented with other healthcare approaches (Anonymous, 2000). The crisis in global healthcare that brings the older medical traditions back into the vanguard gives room for a subtle epistemological debate on knowledge systems. Have we reached a point from where we need to look beyond the ken of science – where we need to seek an alternative not just to medical systems, but to science itself?

Throughout the long span of its evolutionary history, religion, military onslaughts, politics and law have challenged Ayurveda. Once upon a time, Ayurvedic physicians became outcastes on religious grounds because they touched impure and diseased bodies. Centres of Ayurvedic learning and rich collections of medical manuscripts were destroyed by ruthless invaders. The British colonizers politically subjugated Ayurveda and withdrew state patronage. In modern times, international law does not recognize Ayurveda as a legitimate system of medicine outside India, save for a few exceptions.

Withstanding and overcoming these challenges, Ayurveda has survived into the new millennium and is fast gaining acceptance in various forms amongst the general public on a global level. At the same time, it is facing an intellectual confrontation – an epistemological challenge that is more profound than all the challenges that have been thrown at it and that may have far reaching implications in terms of its future growth

and development. The testimony of science is being demanded from Ayurveda to prove itself as a medical system worthy of recognition and adoption by the developed nations of the world.

The scientific validation of Ayurveda has already been initiated, with international bodies like the World Health Organization and the National Institutes for Health announcing research agendas for CAM (Anonymous, 2004; Anonymous, 2002). Only time can tell what the outcome of these projects will be and how they will influence the destiny of Ayurveda. At this critical juncture, an enquiry into the position of Ayurveda as a knowledge system assumes a significance it has never had before. For the simple reason that such an exercise will enlighten us on the innate potential that Ayurveda possesses to withstand the emerging epistemological challenge from the scientific community.

Belief, knowledge and science

The organized systems of thought that humanity has developed through the ages can be categorized as belief systems or knowledge systems. Science is a highly evolved and rigorous knowledge system that has gained such universal acceptance and popularity that it has become synonymous with knowledge itself. In this paper, an attempt is being made to distinguish between a belief system and a knowledge system as well as to characterize science as a specialized knowledge system. An attempt will be made to epistemologically position Ayurveda against the backdrop of this canvas.

Belief system and knowledge system

We can look at five characteristics on the basis of which a belief system and a knowledge system can be distinguished from each other. They are 1. origin, 2. proof, 3. acceptance, 4. revisions, 5. methodology.

A belief system advocates the idea that knowledge has supernatural origins. The concept of divine revelation is central to this system of thinking. Most of the major religions of the world exemplify this approach. On the other hand, a knowledge system professes that knowledge has natural origins and that human agency is the key component in the process of knowledge acquisition. Rational systems of thought that were nurtured in ancient India, Greece and other such parts of the world and, of course, science illustrate this approach.

In a belief system, the authority of a deified personality is the ultimate proof for the validity of knowledge. In very rigid belief systems, a single authority is worshipped as the ultimate source of knowledge. In a knowledge system, however, observation and experience become the criteria for valid knowledge. What cannot be verified experientially does not constitute knowledge.

A cardinal feature of a belief system is the tendency to accept a teaching uncritically and without investigation. Everything is a matter of belief, and nothing can be questioned. A knowledge system accepts a proposition only after a thorough investigation. Any new suggestion is subjected to critical enquiry before being accepted as knowledge.

A belief system resists change and does not allow revision of previously accumulated knowledge. What has been said once is the final truth. A knowledge

system is typically open to revisions and accumulates knowledge on the go. Old theories are modified, elaborated or abandoned, and new theories are introduced.

A belief system is not based on any well-defined or rigorous methodology to acquire and verify knowledge. It just transmits beliefs from one generation to the next. In contrast, a knowledge system thrives on rigorous methodology. Transmission of knowledge itself is a process of verification, wherein the teaching is subjected to rigorous analysis and internalized before acceptance.

The characteristics that essentially differentiate a belief system from a knowledge system can be summarized succinctly in the form of a table.

Feature	Belief system	Knowledge system
Origin	Supernatural origins for knowledge	Natural origins for knowledge
Proof	Authority is the proof	Observation is the proof
Acceptance	Uncritical acceptance	Acceptance after criticism
Revisions	Resistance to revisions	Openness to revisions
Methodology	Lack of well-defined methodology	Has well-defined methodology

Ayurveda as a knowledge system

With this discussion as the background, we can now attempt to explore and define the character of Ayurveda as an organized system of thought. Is Ayurveda a belief system or a knowledge system?

What position does Ayurveda take on the origin of knowledge? Interestingly enough, a careful study of the classical texts of Ayurveda yields contradicting answers. For example, the mythological account of the origin of Ayurveda states that it was first remembered† by Lord brahmā; thereafter, it was transmitted to prajāpati who imparted the knowledge to the aśvini twins from whom indra obtained it (A.H., Su. St. 1.3)‡. These are all mythological characters, and hence at first glance, it appears as though Ayurveda is promoting itself as a belief system by tracing its origins to supernatural sources. indra is the link between the mythological personalities and human beings, and various sages, who were essentially human beings, acquired the knowledge of Ayurveda from indra. In stark contrast, another section of the text talks about direct perception (pratyakṣa), inference (anumāna) and verbal testimony (āptopadeśa) as the true sources of knowledge (C.S., Vi. St. 4.3). A particular passage even goes to the extent of downplaying the importance of verbal testimony and stating that direct perception and inference make up the tools with which the wise acquire knowledge. Sometimes, correlative logic (yukti) is also considered as a valid tool of knowledge (C.S., Vi. St. 4.6). The celebrated Ayurvedic text the caraka samhitā states that the scope of knowledge is to distinguish between what is real and unreal, and this is done by employing the tools of knowledge, which are fourfold – verbal

† The tradition in notion is that knowledge is eternal and not created by any single agency. Thus, from time to time, it is "remembered", i.e., recollected, propagated and used again.

‡ References in parentheses are to the classical texts of Ayurveda. The abbreviations are expanded at the end of the article.

testimony, direct perception, inference and correlative logic (C.S., Su. St. 11.17).Unmistakably, Ayurveda projects itself as a knowledge system through such positioning. One cannot help but be intrigued by the apparent dichotomy of the thought process discernible in the Ayurvedic tradition – a blend of the elements of both belief systems and knowledge systems.

The same ambiguity is reflected in the context of proof of knowledge. There are passages in the classical texts that almost attribute absolute authority to the precepts of a particular individual or revered teacher of the past. The celebrated author vāgbhaṭa, who composed the aṣṭāṅga hṛdayam, for instance, struggles to prove that his exposition is only a repetition of what the authorities of the bygone days have expounded and that he has not deviated even by a syllable from what they have said (A.S., Su. St. 1.20). In spite of being one of the most outspoken exponents of classical Ayurvedic learning, vāgbhaṭa in one context distinguishably characterizes Ayurveda as a belief system. He states that the knowledge of Ayurveda should be used like a mantra, without ever being subjected to critical examination, because it has come down from authoritative persons and produces practical results (A.H.,. St. 40.81). In several other situations, he throws all caution to the wind and criticizes authority without mincing words and advises the aspiring physician to rely on his own intelligence and understanding without blindly relying on the teachings alone (A.S., Su. St. 7.261). In his characteristic and pithy remarks like "a statement does not become acceptable just because it comes from the mouth of a ṛṣi, rather it is accepted on the merit of the truth that it conveys" (A.H., Ut. St. 40.88) and "the fact that oil alleviates vāta, ghee pitta and honey kapha remains unchanged whether it is uttered by brahmā or his son" (A.H., Ut. St. 40.8), one cannot miss the sarcastic tone that scoffs at authority with unveiled contempt. To sum up, Ayurveda fluctuates across the domains of a belief system and a knowledge system when it comes to deciding what constitutes proof for knowledge.

We can notice a much more volatile situation when we try to examine and understand the position that Ayurveda has taken with regard to acceptance of propositions as valid knowledge. The Ayurvedic texts get transformed into an arena for hot debates and discussions. Technical discussions and debates are very much encouraged in the tradition and the teachings are not so easily accepted without questioning (C.S., Vi. St. 8.15). This has given rise to different schools of thought in Ayurveda and variations in theories and explanations of its basic tenets. However, much of the energy seems to have been diverted to proving and consolidating already proposed theories and establishing the supremacy of the older ideas, which ultimately overrides the importance of newer notions. In some instances, new ideas are accepted only if they conform to and do not contradict the already established conceptions, failing which, they are rejected.

One gets the impression that Ayurveda exhibits great flexibility when it comes to the critical examination of a proposition before acceptance but offers much resistance as far as the revision of older theories are concerned. Radical revisions to the basic theories of Ayurveda are literally unknown in the long span of its historical evolution though the expositions have been refined and elaborated, and new applications have been derived from them in the course of time. For example, the tridoṣa theory was well established at a very early period but the concept of the five types of pitta and kapha was a later development. (The fivefold divisions of *pitta* and

kapha are not mentioned in the Caraka Samhita but only in other texts dated at a later period)

Finally, when it comes to methods of knowledge acquisition, the Ayurvedic texts are quite eloquent in elaborating rigorous protocols and systems for validating knowledge. The texts distinguish between speculative thinking (tarka) and definite knowledge (C.S., Sa. St. 7.14). It is the existence of a sufficiently rigorous methodology for the acquisition of knowledge that helps us to characterize Ayurveda as primarily a knowledge system.

This discussion has revealed the dual character of Ayurveda, which appears to take on the features of both a belief system and a knowledge system. How do we make sense of this paradox? In order to understand this peculiarity of Ayurveda, one has to delve into the complex structure of Ayurveda as an organized body of knowledge. The texts clearly state that the knowledge of Ayurveda has been organized to address three levels of intelligence – the dull, the mediocre and the bright (C.S., Su. St. 30.18, C.S. Vi. St. 8. 3). For the dull student, the knowledge of Ayurveda has been packaged as a belief system, and for the bright student, it becomes a knowledge system opening up new frontiers of knowledge. For the mediocre student, it takes on a dual nature and is partly a belief system and partly a knowledge system. The dull witted have been advised to just follow instructions and not to attempt to understand the subtle implications of the teachings (C.S., Su. St. 4.20). On the other hand, the bright person should go beyond what has been taught and discover new knowledge (ibid). The ancient teachings have therefore been clothed in three layers of interpretation, and one will have to delve into the deepest levels to discover the not so obvious character of Ayurveda as a knowledge system.

Ayurvedic knowledge has been organized on a three tier structure, which corresponds to the three levels of intelligence. This constitutes the realm of application (vyavahāra), which is based on operational concepts or theories (śāstra) and which in turn stems from a direct experience of a truth principle (tattva). The dull witted have to just follow instructions (dos and don'ts called vidhis and niṣedhas) at the level of *vyavahara* to get expected results. The mediocre can attempt to understand the *sastra* or theory behind an application and thereby handle it more efficiently. The intelligent student, however, can have a direct experience of the truth behind a theory and improvise or modify the theory as well as invent novel applications. The ideal physician according to suśruta is well grounded in practical applications and delves into the *tattva* (truth content) behind the śāstra (theory) and becomes an innovator or inventor himself (S.S., Su. St. 34.19).

Belief based on direct perception of results (pratyakṣaphaladarśana) is sufficient for one who operates at the level of applications. This has to be supplemented with inference at the level of theoretical discussions. At the level of direct perception of the truth principles, altered states of consciousness have to be invoked and the world of sensory experiences transcended to obtain direct knowledge. The allusion to the origin of the knowledge of Ayurveda from the mythological personalities is an indication that the real substance of the body of Ayurvedic knowledge has emerged from higher states of consciousness. indra, meaning knowledge is sahasrākṣa (C.S., Su. St. 1. 23 indra is referred to by the synonym śatakratu here) (one who has a thousand eyes), with an ability of perception that has been increased thousandfold by rigorous discipline (śatakratu [C.S., Su. St. 1. 18

indra is referred to by the synonym śatakratu here] – performance of a 100 yāgas to purify and refine the cognitive apparatus). Knowledge from the level of tattva is purely a matter of verbal testimony for the dull witted and a matter of direct perception for more advanced seekers.

The level of vyavahāra is always changing as new applications have to be constantly discovered in response to varying spatio-temporal situations. The level of śāstra is relatively stable but subject to modifications, revisions and elaborations, reflecting changes in human understanding of the truth principles. The level of tattva is stable and purely experiential, reflecting the innate and unchanging nature of the fundamental truth principles and laws that govern the universe.

In the light of the above discussion, we can conclude that Ayurveda is essentially a knowledge system with an inbuilt flexibility to present itself as a belief system for aspirants with lower levels of intelligence.

Knowledge systems and science

Let us now try to position science in relation to knowledge systems. Science no doubt is a knowledge system, and the very term "knowledge system" includes science. It is, however, important to realize that science is a specialized knowledge system, which differentiates itself on the basis of some rigorously defined basic premises from other knowledge systems.

What are the characteristic features of science? Science is essentially empirical. Confronted with the limitations of the sense organs, science attempts to expand the scope of sensory perception through sophisticated instrumentation. Valid knowledge originates from observation, and though intuition is recognized as a way to know, it has to be substantiated by the actual observations of multiple observers. Thus, science is not only empirical but also objective. Constant observation being the method of science, it has a characteristic tendency for self-correction. In the light of new evidence, old theories are revised or rejected quite often and replaced by new ones. Science therefore advances in the quantity and quality of the knowledge it accumulates in the passage of time.

Science is concerned with theorizing. Science is empirical like intuition and its higher expression of mysticism. Common sense is also a kind of empirical knowledge but differs from science in that it confines itself to merely a working knowledge of the universe. Common sense accepts an idea as knowledge if it works. But science is concerned about the theory of how something works.

Another important characteristic of science is the process of experimenting wherein a hypothetical assumption is verified by planned observations under controlled conditions.

Last, but not the least, the unique characteristic of science is the criterion of falsification. It is easy to look for confirmations or verification to support the veracity of a theory. But the real test of a theory that would accord it a scientific status is the possibility of attempting to refute it or falsify it. A theory is accepted not just because it can be verified but also if one fails to falsify it (Karl Popper, Conjectures and Refutations, London: Routledge and Keagan Paul, 1963, pp. 33-39).

We can thus arrive at the understanding that science is a specialized kind of knowledge system with unique characteristics.

Ayurveda and science

At the very outset, it has to be emphasized that there are both points of divergence and convergence between Ayurveda as a knowledge system and as a science. Both Ayurveda and science are empirical, but science, as mentioned earlier, does not formally accept intuition and common sense as valid sources of knowledge. Ayurveda includes all these and also objective methods as sources of valid knowledge. Thus, one of the essential differences between Ayurveda and science lies in what constitutes a source of valid knowledge.

The next difference is in the operational realm. Being empirical, both Ayurveda and science rely on sensory observations. But, when confronted with the limitations of the sensory apparatuses, Ayurveda attempts to transcend the sensory realm through mystical approaches to knowledge (alaukika pratyakṣa), whereas science extends the scope of sensory perception with technology.

On account of the differences in the sources of knowledge as well as at the level of the reality on which they operate, there is a certain degree of incommensurability between Ayurveda and science. This incommensurability stems from paradigmatic differences and becomes more pronounced when science attempts to understand Ayurveda. This is because science adopts an exclusive approach while Ayurveda is inclusive. Problems of incommensurability can be better tackled if Ayurveda attempts to accommodate the methods of science in a proactive way. When science approaches Ayurveda, there is a danger of reductionism trimming the scope of Ayurveda within the framework of science. On the other hand, if Ayurveda approaches science, there is a better chance of preserving the totality of Ayurveda as a knowledge system.

The rest of this paper is a discussion to explore whether Ayurveda has the potential to meet the scientific challenge in terms of methodological rigour in knowledge building. For this, we need to see whether there are at least a few major points of convergence between Ayurveda and science.

The very word "Veda" is an elaboration of the process of knowledge acquisition. This word means existence, conceptualization, analysis and realization (The word veda is derived from the root vid, which has four meanings – sattā, jñāna, vicāra and prāpti. sattāyām vidyate vetti jñāne vinte vicāraṇe, vindate vindati prāptau rūpabhedā videh amī). There are four stages in the knowledge cycle, which starts with the observation of existent phenomena and their conceptualization. Such conceptualized knowledge is transmitted as a teaching and subject to analysis and internalized experientially.

Knowledge seeking is an attempt to differentiate between what is real and what is unreal. This is clearly an empirical exercise, and all knowledge is experiential. But all expressions of empiricism cannot become knowledge or, in other words, knowledge is experiential but all experience is not knowledge. Validated experiences alone become knowledge, and therefore, knowledge acquisition is all about validating experience (Tarkasangraha, pp. 152, 153).

The tools used to validate experience are called as pramāṇas, and the number and type of pramāṇas vary from system to system. Ayurveda recognizes at least three such tools or pramāṇas – verbal testimony, direct perception and inference and also correlative logic in certain contexts, as already pointed out earlier.

The knowledge gained through verbal testimony is basically conceptual (jñāna). When it is verified through direct perception and inference, it becomes experiential

(vijñāna). Therefore, the real tools of validating knowledge are direct perception and inference. This exercise is technically known as parīkṣā, meaning investigation (C.S. Su. St. 11.26).

Thus, we can conclude that Ayurveda accepts empirical knowledge only after validation and only if it meets science eye to eye, in this regard.

The need for objectivity is also emphasized in the Ayurvedic tradition. Knowledge has to be theorized, objectified and validated by multiple observers before it is accepted as a doctrine or siddhānta (C.S., Vi. St. 8.37). anumāna, one of the tools to validate experience, is not merely inference but inference based on perception. anumāna proposes a rigorous methodology to establish causal relationships between events in a systematic way.

When an association between two events is observed repeatedly a number of times, a correlation is suspected. This is called sāhacarya or vyāpti (Tarkasangraha, p.160). Establishing this correlation is tantamount to discovering a law and helps us control the event. In scientific parlance, this is the study of two variables: one independent and the other dependent.

However, mere association cannot help us formulate a law of correlation between two variables. Certain other criteria will also have to be fulfilled. They are 1. the law of exclusivity (avyabhicāritva) – the dependent variable should not be influenced by an independent variable other than the one being studied, i.e., it should be exclusively associated with the independent variable under study; 2. the law of invariable concomitance (avinābhāvasambandha) – the two variables should always be seen together or, in other words, the dependent variable should be influenced by the independent variable on all occasions of observation and 3. the law of inherence (ayutasiddhatva) – the two variables should always coexist and should not be observed independent of each other (Tarkasangraha p. 160 - 171). In this approach, we can discern the rudiments of the experimental method to validate hypothetical assumptions.

In the biomedical context, the clinical trial design seeks to study a trial drug against a control and a placebo. For the trial drug to be acceptable, its action should be comparable to that of the control and not comparable to that of the placebo. This is very similar to what is meant by pakṣa, sapakṣa and vipakṣa in the process of validation through anumāna (Tarkasangraha, pp. 165,166).

sapakṣa is equivalent to the trial drug; in the situation in which a particular effect is doubted as existing. pakṣa is the control, in the situation in which the effect being studied is proved to exist. And vipakṣa can be compared to the placebo; i.e., the situation in which the effect being studied is established as being non-existent. Such a suggestion does not seem to be altogether improbable, and it does look like the importance of validation of clinical outcomes was recognized in ancient days. The caraka samhitā states clearly that a clinical outcome that has not been validated by proper reasoning can only be dismissed as accidental success (C.S. Si. St. 2.28).

It is beyond the scope of this paper to engage in further discussions on the parallels between Ayurveda and science. The objective of this discussion has been to demonstrate the fact that though not a science in the strict sense of the word, Ayurveda has the right ingredients ingrained in its epistemology to confront the scientific challenge that has been thrown at it in recent times.

The future of Ayurveda as a knowledge system and as a medical system in its own right will very much depend on how successfully it understands and accommodates science and, at the same time, how it operates from within the larger framework of its epistemological foundations.

Abbreviations

CS – caraka saMhitA; SS – suCruta saMhitA; AH – aSTAGga hRdayaM; AS – aSTAGga saMgraha; Su.S. – sUtrasthAnaM; Sa.S. – CArIrasthAnaM; Si.S. – siddhisthAnaM; Vi.S. – vimAnasthAnaM, Ci.S. – cikitsAsthAnaM, Ut.S. – uttara sthAnaM

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Traditional Knowledge Guided Research and Standardization of Traditional Medicines

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Abstract

Traditional medical systems have evolved within different epistemologies and perspectives on disease, cause and cure. The epistemic framework, principles, concepts and practice are quite different from those of modern medicine. Traditional Indian sciences or "shastras", as they are called, possess qualitative standards that are derived by a subjective but impersonal approach to standardization. While there is a contemporary value in applying modern science and technology tools to create objective and verifiable standards for traditional knowledge products, and concepts, currently the approach to creating standards is one-sided. This is because it does not adequately consult the available qualitative traditional knowledge based standards and parameters. This paper cites constructive examples that illustrate the imperative need for collaboration between scientists and traditional knowledge experts so as to promote mutual understanding for appropriate research and to create authentic quality standards.

Introduction

According to WHO, 80% of the rural population in developing countries depends on traditional medicines (TMs) to meet their primary health care needs (Bannerman *et al.*, 1993). This is a huge contribution by these systems of medicine and is grounds enough to invest in their standardization and development. Such investment in standards will ensure that local communities continue to enjoy the benefits of traditional healing for centuries to come.

In the last few decades, there has also been an increasing interest in and use of traditional treatments in urban areas all over the world. This use is for a wide range of diseases (infectious, chronic and systemic) like malaria (Willcox *et al.*, 2004), cancer (http://cancer.gov/search/clinicaltrials; Cordell *et al.*, 1991; Balachandran and Govindarajan, 2005; http://manderson.org/departments/cimer) and, more recently, HIV/AIDS (Burcher, 2004; WHO, 1989). Acupuncture and yoga are also becoming popular TM therapies used globally for relieving pain, nausea and asthma (WHO, 2002; http://www.cochrane.org/reviews). The growing importance of TMs is reflected by developed countries setting up centres for studying its use in treating HIV/AIDS, cancer and other diseases. The National Centre for Complementary and Alternative Medicine (NCCAM) established by the US Government and collaborating centres of WHO in different countries are examples to indicate this.

Questions regarding the quality of TMs have become an important issue today, mainly because of the current demand, which in turn has led to TMs being manufactured in large quantities for global use. Problems associated with the logistics of large-scale production and with the economics and distribution have necessitated

developing modern standards for evaluating the quality, safety and efficacy of these medicines. They have become the main concerns not only for consumers but also for regulatory authorities across countries. The challenge is to develop appropriate modern, western standards for medicines that originated in different world-views and cultural settings.

Traditional quality standards and their social and epistemological context

In a sociological perspective, it is evident that any living and evolving health tradition that has served society for several millennia could have only sustained itself if it had internal quality standards (Shankar, 2002). Asia, Africa and South America have long histories of such traditions. Generally, in most societies, health traditions are undocumented, and therefore, they are transmitted orally from generation to generation via a fascinating, non-institutionalized educational process (Shankar, 2001). The transmission process is poorly understood in spite of its remarkable efficiency and outreach. However, in countries like India and China, medical knowledge has also been documented in thousands of medical manuscripts.

In most traditional health cultures, standards are available as advice or recommendations for identity and collection. The collection is prescribed in terms of season, stage of maturity and even the preferred habitat of collection. There are standards for storage, post-harvest processing and for finished products. There are also standards for safety as well as for efficacy. Sensory perceptions and physiological responses are usually used traditionally to test the quality of drugs. The chart below (Table 1) provides examples of these standards referenced from primary texts of a major Indian system of medicine, *viz.*, Ayurveda; similar standards also probably exist in other systems of TM. It is therefore very important to disabuse our minds of the notion that traditional systems of medicine lack standards.

Table 1. Examples from Ayurveda on traditionally used quality standards

Standards for	Example	Ayurvedic textual source
Identity	*Gudoochi* (*Tinospora cordifolia*) is a rope-like perennial climber. When cut, it regenerates from the stem. On the transverse section, a circular structure can be seen. Leaves have a viscid juice. Seeds are semilunar in shape.	Sharma, P.V. 2000. *Namarupajnanam*. Satyapriya Prakashan Publisher, Varanasi,.p.76
Collection	The fruits of *Madana* (*Randia spinosa*), which are very good as an emetic drug, should be collected between spring and summer in *pusya*, *aswini* or *mrgasiras* constellation.	Sharma, P.V. 1998. (Ed.) *Caraka Samhita* IV Edition, Volume. 2. Chaukhamba Orient Alia, Varanasi, pp.540–541

Processing	*Piper longum* is recommended for use as *ksheerapaka* (milk decoction).	Sharma, P.V. 1994. (Ed.) *Cakradatta.* Chaukhambha. Orientalia Publisher, Varanasi
Storage	*Mahaneela Taila* should be stored in iron vessels.	Sharma, P.V. 2000. (Ed.) *Charaka Samhita,* Vol. 2. Chaukhambha Orientalia Publisher, Varanasi, p.453
	A storage period of at least one year is recommended for the seeds of coriander and the fruits of long pepper in order to obtain the best medicinal use.	Sastri, P.P. 1983. (Ed.) *Sarngadhara Samhita*, Prathama Khanda 1:45, Chaukhambha. Orientalia, Varanasi

The problem is that traditional standards are to be practiced by the primary actors, *viz.*, the collector of plants, the person who stores the plants and the physician who prepares and administers the medicine. In traditional societies, the social distance between the primary actors and the customer was small. Thus, standards were assured on the basis of reputation and were therefore dependent on the integrity of the collectors and physicians. In the context of industrial manufacturing and global distribution and use of products and services, the traditional standards can no longer be directly applied. This is because the primary actors cannot be involved in a face-to-face and socially intimate relationship with millions of customers, and there are several players involved in the chain. Moreover, the scale of operations in an industrial setting is much higher than that in the traditional one and other factors such as logistics and economic viability come into play. The modern usage of TM, therefore, needs a set of standards for quality, safety and efficacy that can be verified independently by customers or by regulatory authorities on their behalf.

How should one go about establishing standards in the relatively recent context of modern, large-scale use of traditional drugs and therapies? Should one re-invent the wheel? Or should one piggyback on centuries of past experience in the setting of standards? The answer may appear evident to an objective observer of this scenario. Why re-invent the wheel should be the obvious response. Yet, strangely enough, in many modern pharmacognosy and pharmacology laboratories all over the world the attempt indeed has been to re-invent the wheel. This becomes exceedingly clear when one notices the superficial and feeble efforts of these modern scientific institutions to understand and consult traditional knowledge in a comprehensive fashion.

In fact, modern tools of chemistry and biology are capable of at least partially objectifying traditional standards where they exist. One should however not expect to get a perfect match between the traditional standards and corresponding modern parameters because their proper correlation with modern parameters is in fact a matter of serious inter-cultural research. However, it is certainly worthwhile and sensible to undertake this kind of research because it can save a great deal of time and resources, which would inevitably be involved if one were to start *ab initio*. It is also

likely to be very fulfilling because it can provide access to the intellectual insights and cultural experiences of several previous generations.

Understanding the context of inter-cultural research is absolutely necessary when discussing the relationship between traditional and modern sciences. The context is created because of the difference in their world-views (Shankar and Unnikrishnan, 2004). Traditional sciences recognize the physical, biological and spiritual planes of existence and see the three on a continuum wherein each plane is merely a transformation of the other. Western science on the other hand, thus far, only acknowledges the existence of the physical and biological worlds. Even with respect to these, their schemes for understanding nature are different. Atomic theory explains the western perception of the natural world, whereas in traditional Indian sciences, for instance, natural objects are perceived in terms of not their atomic configurations but in terms of their *pancha maha bhuta* (five element) configurations. This difference in the world-views, foundational theories and categories of the two sciences should decide the methodology that is used for establishing functional correlations between the two.

In the section below, the authors discuss some of the practical problems involved in the use of modern tools for objectifying traditional standards. Since the authors are very familiar with the Indian traditional medical science of Ayurveda, this system has been used to illustrate the scope and limitations of using modern tools to develop standards for TM.

The scope and limitations of using modern tools for standardization of herbal products

In the current global context of a resurgence in the use of herbal products, a booming market for natural products and a rapidly growing consumer acceptance of complementary medicine, it is imperative to urgently evolve sensitive modern standards for the quality, safety and efficacy of TMs (WHO, 2000).

Quality assurance of TMs involves the quality of both raw materials, mostly plants but also animals, metals and minerals, as well as of finished products. The starting point is establishing the identity of the raw material. It is very important to be aware that the primary identity of the *materia medica* can only be decided by a reliable traditional source. Subsequent to this identification, biological (morphological), microscopic, chemical and biochemical methods are available to undertake standardization of the traditionally identified material and they should be appropriately applied. A practical problem that sometimes occurs in this regard is that a traditionally named plant material, for instance, may have more than a single botanical source. In the context of Ayurveda, the plant name *brahmi,* for instance, refers to at least two botanical species, *viz.*, *Bacopa monnieri* and *Centella asiatica*, both of which possess similar properties (Sastri, 1993) and can be substituted for each other. In such cases, the standardization will need to be done for both the species.

Establishing standards for identity is only the first stage or level of standardization of a raw material. Higher levels standards can be established when a raw material is also standardized in terms of its traditionally prescribed collection time, region of collection, manner of processing and storage conditions (Venkatasubramanian, 2001). Plant materials collected as per traditional collection

prescriptions like maturity of the part are richer in phytoconstituents than their immature counterparts (Venkatasubramanian, unpublished results). Scientific studies have shown that using a traditionally recommended medium for processing a raw drug can increase the bioactivity severalfold (Sudha *et al.*, 2004). Since biological materials are inherently variable, it is also necessary to standardize the sample size so that it takes into account the variability.

Today, the quality standards for raw drugs prescribed by pharmacopoeias cover aspects such as morphology, microscopy, physicochemical characteristics, nature of phytoconstituents and chromatography profiles. They are not as of now sufficiently sensitive to the traditional quality standards prescribed by different traditional health cultures in Asia, Africa and South America.

The more complex aspect of quality assurance relates to the standardization of finished products. The complexity arises because traditional products of different cultures are processed to create a wide range of dosage forms from simple single plant powders to polyherbal extracts. The finished products may be aqueous extracts, herbal wines, herbal oils, baked products, plant starches or alkalis. Standardization of all these myriad dosage forms poses a real challenge to modern scientists. The challenge is threefold: firstly, to identify appropriate tools to tackle the complexities, secondly, to use tools that are cost-effective and relatively easy to follow and, thirdly, to design tools that are not only for the control of the quality of ingredients and products but also for on-line process control.

A combination of physical, chemical and biological techniques and tools are required to study TMs, depending on the nature of the product. The role of a taxonomist in an herbal industry cannot be overstressed, since the correct identity of the plant material is the starting point for all herbal medicines. Microscopy to characterize raw drugs and powdered drugs has been a very useful tool for many in the herbal sector. While chromatographic tools such as High Performance Thin Layer Chromatography (HPTLC) and High Performance Liquid Chromatography (HPLC) can be used for fingerprinting herbal products, other tools such as the Flame Photometer and the Atomic Absorption Spectrophotometer (AAS) are required for studying TMs containing metals or minerals. Volatiles are generally quantified using Gas Chromatography (GC). Higher-end, sensitive research tools such as Nuclear Magnetic Resonance (NMR), Electron Spectroscopy for Chemical Analysis (ESCA) and Mass Spectroscopy (MS) can be used to study TMs and characterize the compounds of interest. Molecular DNA based techniques have become an important tool to study intraspecific and interspecific variations in crude drugs of plant and animal origin. *In vitro* biological assays have also been used in research, standardization and quality control (QC) of TMs.

No one tool can answer all the issues of TM standardization, and the selection of a tool for use for a particular product would depend on the nature of the product, its intended purpose and the resources available. It is also possible that available technologies and biological models may not be able to handle the complex mixtures of TMs. Many a time, a tool, which is suitable for research purposes, may not be well suited in the QC context for use on a regular basis by a TM manufacturer. It must also be borne in mind that most of the current technologies were developed for the pharma industry where the trend and requirement was to study single compounds and therefore not directly suitable to complex mixtures as is found in TM. The coming

years should hopefully see the gap being filled by suitable tools being developed for studying polyherbal and complex formulations (Hostettmann and Marston, 2002).

Today, regulatory authorities in importing countries like Germany have restricted the role of TMs to supplements that can only be used for "indications such as invigorating and strengthening and cannot be intended to cure or treat disease" (Blumenthal, 1998). Moreover, most of the pharmacopoeial standards available globally have been restricted to single plant extracts or, at best, extracts of five herbs as fixed combinations. Obviously, this truncated approach to the promotion of TM deprives global consumers of the benefits of the rich and effective diversity of traditional remedies.

In the matter of safety, traditional remedies will need to be assessed on the same parameters as are used for the assessment of modern pharmaceutical, nutraceutical and cosmeceutical products. However, WHO first accepted that TMs that have a documented historical use may need shorter and fewer preclinical toxicological evaluations (WHO, 1993; Chaudhury and Chaudhury, 2002). The current requirements of regulation in this regard vary from country to country (WHO, 1998), and these should be accepted by all traditional medical cultures.

It is in the matter of efficacy of TM that a rational strategy needs to be adopted. A traditional physician usually diagnoses the patient and prescribes a therapy including medication for the disease, which is best suited to the constitution of the patient. The other aspects of the therapy could include exercise, prayer and meditation, massage or any other manual procedures. The entire treatment is a disease management package; suitable clinical trial protocols need to be created to assess the entire package. Conventional double-blind, placebo-controlled clinical trials may not always be necessary or appropriate for well-used TMs. Single case studies and observational studies are valuable in this regard, where the TM practitioner continues his treatment without modifying it in any way and the clinical investigator observes whether clinical improvement takes place (Chaudhury and Chaudhury, 2002).

Old herbal products already available in the German market and that could not meet Commission E standards were accorded TM status in 1992, which permitted the re-registration of TMs without requiring rigorous studies and scientific data on a specific product. While traditional products must be safe and meet the quality standards of the Commission E, proof of efficacy can be the demonstration of use for many years (Blumenthal, 1998). This is a progressive rule, but its operationalization needs to be worked out in a fashion that is fair and makes the best use of traditional medical cultures that are located outside the European Union.

Recommendations for the future development of standards

It is important to appreciate the advantage of building quality assurance standards for traditional remedies based upon the traditional quality standards that have already been established in traditional cultures over centuries. In order to adopt this approach, pharmacognosy laboratories for TMs need to initiate building up of a database on the traditional quality standards of those systems of TM in which they are interested. Such a database may require field studies in the case of a health tradition that is undocumented and also literary research in the case of a codified tradition.

In the context of quality of raw materials, it is not sufficient to set standards based on the accurate biological identity of the material, although this can be the first step in the development of pharmacopeias. Higher standards would however be met when the standards take into account traditional prescriptions relating to the collection of raw materials like season, stage of maturity, ideal habitat, optimal time of the day and so on.

In the case of safety, the currently accepted scientific protocols for establishing safety of raw materials and finished products should be followed while also taking into account traditional advice, if any, pertaining to detoxification of raw materials before and during processing of the concerned material, contraindications, administration period etc.

Establishing modern standards for efficacy presents the biggest challenge for the mainstreaming of traditional systems of medicine. In most systems of TM, it is usually not only a drug that is responsible for effective treatment but the drug in combination with a prescribed diet and mental and physical state. Furthermore, the disease aetiology and its classification system in traditional systems of medicine do not have a one-to-one correlation with the scheme of western biomedicine. Traditional theories of disease often attribute a disease to multiple causative factors that affect homeostasis rather than to a single causative agent. This gives rise to two orders of problems. The first order problem is that unconventional evaluation protocols are needed to assess a treatment package rather than a particular drug. The second order problem is one of selecting appropriate modern clinical, physiological, psychological or biochemical parameters for evaluation of a treatment, which correlate reasonably well with the traditional understanding of the disease condition. Although this situation may initially confound a researcher, it is in our view a characteristic feature and an inevitable complexity of inter-cultural medical research. It therefore calls for an innovative *management trial approach*, for evaluating the efficacy of traditional treatments on sensitively selected parameters, in place of the conventional *drug trial approach*.

It needs to be clearly understood by policy makers and medical researchers that the matter of evolving reliable standards for the evaluation of traditional systems of medicine is a subject of inter-cultural research. Its serious pursuit can enrich the field of medical pluralism, which appears to be the best future direction for advancement of world medicine.

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Indigenous Methods in Sri Lankan Agriculture: Belief, Mysteries, Myths or Science[Ψ]

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Abstract

The underlying concept in indigenous technology in agriculture is based on accepting man and his behaviour as a necessary component of nature. Methods adopted in agriculture are never haphazard but are purposely designed to merge with the ecosystem and be natural rather than to compete with nature. From land preparation to harvesting, all the steps in agriculture were carried out to conserve energy as in the biological systems approach and to conserve water and biodiversity, essential for a sustainable ecosystem. Watershed management for the efficient management of the ecosystem was a major aspect of indigenous agriculture. The choice of plant species grown in watershed areas and on the bunds of reservoirs is evidence of this aspect of management and of the "bio/phyto" remediation of water resources. The concepts underlying indigenous agriculture will be discussed in this paper using rice farming as a case study.

[Ψ] The full text of these papers are currently not available and hence the abstract alone has been presented here.

Universities: From Assessment of Traditional Knowledge to Intra- and Intercultural Dialogue and Coevolution

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Abstract

Universities are increasingly getting interested in traditional knowledge on agriculture, but their attention is often strongly focused on technologies. Traditional agriculture has more aspects: its cultural, social and spiritual dimensions are at least as interesting. The "Why to do" world vision based wisdom of traditional agriculture is strongly determining the "How to do" practice. This statement is demonstrated with two examples, one from Africa and one from Latin America. These examples show that, among other things, ecological sustainability is an important implicit value of traditional agriculture. These values may be even more important for modern farmers than low-cost traditional organic soil fertility, pest management or other practices.

Both modern and traditional farmers need to adapt their world vision and practices to the fast changing conditions and needs of the world. In such processes of adaptation, farmers and scientists can gain a lot from intra- and intercultural dialogue on agriculture. If universities are ready to collaborate on an equal footing with communities and their traditional leaders and can accept that traditional knowledge has cultural and spiritual dimensions as well, they can play an important role in reconstruction, revitalization and the further evolution of traditional agricultural science. Eventually, such initiatives may lead to coevolution of agricultural knowledge.

Information is coloured by culture. To really understand the value of information, we need to know about the culture of its origin and the culture of the person who transmits the information. In this case, I am from the Netherlands. I have a liberal Christian background and an academic education in land use planning and soil and water conservation. I gained my first intercultural experience in the Middle East and West Africa in the seventies and worked for six years as a development worker in West Africa in integrated programmes. Back in the Netherlands, I found employment with ETC Foundation, a consultant organization active in developmental co-operation in the South and the North. At ETC, I worked for a long time as content editor of LEISA Magazine and, for the last three years as content editor of Compas Magazine. The partners in the Compas programme are from Asia, Africa, Latin America and Europe and have different cultural and religious backgrounds, including among others, people belonging to indigenous faiths, Hindus, Buddhists and Christians. Intra- and intercultural dialogue therefore are at the heart of the programme.

Technology influenced by ecology, economy and culture

I brought with me a traditional product from the Netherlands, Gouda cheese. This traditional cheese is produced by conventional modern farmers using the newest scientific insights into cheese making. If you were interested in producing this traditional product in India, I could tell you about the technical process of cheese making. But, would this be enough for you to assess whether this could be an interesting product to produce on your farm? Knowing only the practical information on how a farmer transforms her cows' milk into cheese will not be enough for you to make this cheese and to know whether this could be a viable enterprise in your conditions. For example, if this cheese were being produced by a biodynamic farmer on one of the Frisian Islands, you should also know about the specific ecological conditions of the farm, e.g., about its specific soil, meadow vegetation and climate. Biodynamic farmers, who in Europe are among the farmers closest to traditional agriculture, also make use of cosmic forces to optimize the ecological functioning of their farms. They care very well for their farm animals so that these animals can fully express their inner selves. As Christians, the farmers are well aware of their duty to take care of God's creation and to respect all life. In their daily prayers, they ask for divine blessing for their farms. The cheese is produced on the farm and commercialized through a co-operative of biodynamic farmers. As their organic production process is certified, these farmers receive a higher price than conventional farmers.

With all this information, it becomes clear that it may not be so easy to produce the same cheese elsewhere in a different ecological, economical and cultural setting. Technology has to be adapted to local conditions, which may be problematic if the practice comes from a different culture or from farmers with as big differences in their vision on farming as between traditional and modern farmers.

In the Netherlands, modern diary farming is far from sustainable and economic pressure on farmers is high. At the farm level, biodynamic dairy farming is performing relatively quite well, ecologically as well as socially and economically. However, at the macro level, they function fully within the neoliberal fossil energy dependent consumer society that for many reasons is unsustainable.

Cosmovision important

More and more universities have started to collect information on traditional agriculture as traditional practices may be of use to contemporary farmers as well. But in their efforts, they tend to forget that the exchange of experiences between traditional and modern farmers increasingly needs an intercultural dialogue to fully understand not only the "How to do" but especially also the "Why to do" of traditional agriculture. The information collected is often limited to technical, biological and socio-economic aspects. Sometimes, ecological information is also included to describe local conditions. Information on the cosmovision of farmers and on traditional institutions and spiritual practices, especially when not well understood by scientists, is normally missing. But these aspects are an integral part of traditional agriculture as well. For example, I once heard a nice story on the prevention of termite

damage in Tamil Nadu. If I understood it well, but maybe some of you may know it better, it appears that certain traditional farmers in Tamil Nadu feed the ants on their farms regularly as part of a ceremony to honour a specific goddess. Remnants of the temple of the ants can still be found. Although this may not have been the official objective, the practice seems to have been effective in protecting paddy from termite damage. Some crazy old farmers still feed their ants, with good results. Maybe some modern farmers and scientists will take such practices seriously again, with or without the rituals and the help of the goddess and the cosmovision she represents.

The challenge for universities is not only to look at traditional practices but also to try and understand the traditional sciences behind these practices, the practical concepts and the fundamental principles.

Ancestor centrism

The "How to do" of farming is directly influenced by the "Why to do". In "modern scientific" agriculture, the "Why to do" is mainly focused on profit maximization. In traditional agriculture, the focus of "Why to do" is much broader. This is not only due to its strong orientation on subsistence production but also as traditional farming is well embedded in the local cosmovision. For example, in the savannah of North-west Ghana, most of the *Birifor* are still traditional farmers practicing a mixed bush–fallow subsistence system cultivating millet, sorghum and yams besides some beans, groundnuts, rice and maize. They have some cattle, goats, poultry, pigs and sheep (Dessein, 2005). To the *Birifor*, their fields are not merely for food production but are also an essential link with their ancestors. For them, the world of the ancestors, the not-yet born and other spirits and divine beings is as real and important as this world. To become "excellent" farmers, like their ancestors, specific ceremonies, rituals and farming practices have to be performed that, among others things, are determined by gender, the phase in life cycle and ancestor centrism. Correct performance leads to social recognition in the community as well as by the ancestors.

In the opinion of scientists and the government, these traditional practices are inefficient and should be replaced by modern agriculture, but in the vision of the *Birifor*, their way of farming represents the essence of life and of their identity, which should not be changed. Still, there is need for change as the population is growing, the productivity of the fields is going down, ecological degradation and poverty are spreading and the cultural influences from outside the community are manifold. But how can change be enhanced without risk of loss of control and identity for farmers? The local cosmovision and the ancestors should be involved in this process as they are the central focus of this society and the traditional providers of all local knowledge. Communication with ancestors through rituals in which priests and soothsayers and men and women play a central role is therefore an important aspect of agricultural development for the *Birifor* as well as for other traditional cultures in Africa.

Reciprocal conversation with the Pachamama

In the high mountains of the Andes in Latin America, the concept of farming and life is quite different from the capitalist concept that is now widely propagated globally (Mendoza and van Kessel, 2005). *Quechua* agro-pastoral subsistence farmers, or

"runas", consider themselves "incomplete beings". To "nurture life" in the Andes, with its intense climatic variability and ecological diversity, solidarity and reciprocity is required between members of the community, the gods and the Pachamama, or Mother Nature. Just as with the *Birifor* in Ghana, all activities revolve around the central role of agriculture. This symbiotic relationship of the Andean farmer is based on concepts such as the world as a living and personal entity; reciprocal conversation with the Pachamama and the gods; the feelings of respect, community and relationship; work as a celebration of the permanent nurturing of life and the celebration of life in the daily rituals of agricultural production.

The best way to achieve "plenty with sufficiency" and to maintain a balance is to "converse", through rituals, with other beings to understand what they need.

Between people living in different ecozones or with different skills, products are being exchanged during traditional fairs. In some places in the Andes, these fairs have evolved as big annual happenings of a religious, ritual and festive nature. The western notion of market where competition between farmers enhances efficiency, quality and low prices is not applicable in the local conditions of the Andes where competition leads to social and ecological disaster.

Built-in sustainability is getting lost

Also, in the Andes, the "Why to do" is leading the "How to do". Traditional knowledge in the first place is about conducting life as it should be lived in the perspective of the traditional cosmovision. The "Why to do" therefore is inseparable from the "How to do". This not only guarantees the optimal well-being of the community but also ensures ecological sustainability, one of the built-in objectives of traditional agriculture. This is demonstrated by the following quote of a *Quechua* farmer:

"The alpaca is our mother and our sister, who the Pachamama has given us, no more than loaned, and who came from the paqarinas (the high Andean springs). We must look after her with care so that she does not return to the heart of Mother Earth. The irrigation water too was brought from the heart of the Pachamama, with golden drum, music and chants. So, both the alpaca and the irrigation water preserve the perfect equilibrium of the world. If we make them suffer, then humans cease being runas and become savages, or wack'as. Runas must not fight over alpacas or over irrigation water; if they do, they will return to the breast of the Pachamama".

This does not mean that traditional agriculture is always sustainable. In the fast changing conditions of the present time, this is often not the case any more. Owing to the commercialization of basic agricultural principles such as social reciprocity, caring well for animals and ecological sustainability are gradually losing their importance as parts of the "Why to do" of agriculture. In modern agriculture, scientific knowledge, agrochemicals, mechanization, transport etc. make it possible to harness fossil energy to increase production, make farming less laborious and sell products in far away markets. This change in orientation and technology is very attractive as it makes increases in production and income and the globalizing consumer culture possible. However, this change is also strongly contributing to the growing social and ecological disaster that is threatening modern society and that is reflected, among other things, in the growing gap between the few rich and the many poor, the changing climate,

ecological degradation, loss of traditional values and knowledge and disintegrating communities.

Revitalizing traditional knowledge and ways of knowing

Interest from scientists and farmers in traditional agriculture is often for commercial reasons: genes with high market value, cheaper inputs and organic products to gain higher earnings from export. Also, many traditional and indigenous farmers are interested in commercialization of their traditional products to gain some financial income as their globalizing society makes this nearly unavoidable. However, for many others this is going against their vision on how agriculture and life should be conducted.

For many people, in many countries, traditional practices are also important because they cannot afford the costs of modern inputs, medicines and consumer goods. From the view- point of the market economy, they have become or are still economically unviable and therefore cannot benefit much from modern development. Most marginalized rural, traditional and indigenous people, especially those in ecologically vulnerable and risky conditions or those far away from the market, belong to this category. Their chances in the market can be improved only to a limited extent by way of modern technology, improved marketing and good governance.

Many farmers want to revitalize their traditional knowledge and culture because they are increasingly aware of the limitations and risks involved in modern commercial agriculture and its interrelated consumer lifestyle. For a long time until it became dominated and partly replaced by western culture, traditional culture did serve well. In their vision, revitalizing traditional culture and traditional agriculture, not only the practical "How to do" knowledge but especially also the motivational "Why to do" wisdom, may solve present problems to large extent. Besides, it is their cultural right to recover their traditional heritage and to "decolonize" their knowledge and society.

However, much of traditional knowledge and its inner logic or science may be lost or hidden. To unearth and activate this knowledge again, it may also be necessary to look at traditional ways of knowing, which may include spiritual and other unconventional ways of observation such as ritual communication with the ancestors and the Pachamama, meditation, dreaming, divination etc. Analysis of traditional language may also play an important role in understanding traditional knowledge in the right way again.

Reconstruction and revitalization of traditional knowledge, for one or several of the above reasons, is asking for a developmental approach that starts from within the local culture. The Compas programme calls this endogenous development. As traditional knowledge and knowing may not resolve all the problems of a population, close co-operation with modern science may be very useful as well. At present, Compas and many other organizations are developing strategies and methodologies to support endogenous development, which may cover all aspects of traditional knowledge and knowing and intercultural dialogue between traditional knowledge and modern science.

Intra- and intercultural research and education

In Latin America, but also in Africa and Asia, at several universities there are now serious initiatives for intra- and intercultural education and research in which local communities and their traditional and spiritual leaders play an important role. Compas is deeply involved in some of these initiatives (Vargaz and Delgado, 2006). Even in countries such as Bolivia and Ghana where the majority of the population is indigenous, universities are nearly completely focused on western scientific knowledge that does not recognize other knowledge traditions.

Indigenous people do not any longer accept this situation of cultural domination and lead these initiatives for educational reform by standing up for their human right to cultural liberty. They see intra-cultural dialogue about their own culture in the local language as a necessity to decolonize, heal, revitalize and innovate their traditional knowledge.

Students belonging to indigenous faiths also want and need to understand western scientific knowledge but often have great difficulty in doing so as the indigenous concepts strongly differ from western scientific concepts and are not recognized as valid and valuable by universities. By fully understanding their own culture first, it would be easier for them to understand the knowledge of foreign cultures and to hop between the knowledge systems of different cultures in an intercultural dialogue.

Also, in indigenous research programmes, it is important to analyze reality through both the indigenous, tribal or traditional perspective and the western scientific perspective and to enhance social learning through intercultural dialogue. Experience in Thailand (Blake and Pitakthepsombut, 2006) shows that the local population can function very well as indigenous researchers. In this way, both intra- and intercultural dialogue can be activated and traditional and modern knowledge and wisdom may find a way to support each other. This may be possible as long as local people stay in control of their knowledge and destiny are not highjacked by national or international economic, political or scientific interest groups.

A challenging road to travel on

On the basis of my experience as editor of LEISA Magazine and Compas Magazine, I have the impression that if universities and scientists are really interested in traditional knowledge in all its dimensions, it may be best for them to support indigenous, tribal or traditional communities in their efforts to revitalize and improve their traditional knowledge. Together they could initiate intra- and intercultural research and social learning programmes on how to strengthen and sustain local communities in the fast changing and globalizing world. Eventually, this could grow into a broader and more systematic intra- and intercultural research and education programme contributing to the reconstruction and revitalization of traditional knowledge. Part of the experiences and knowledge gained could be shared more widely with other traditional and modern farmers in settings of intercultural dialogue. Intra- and intercultural understanding of the implications of the necessity for social well-being and ecological sustainability would be an important issue to look at as well. International sharing of these insights may also challenge western sciences and universities to take traditional knowledge and

wisdom seriously, not only as an interesting human heritage but also because of its potential contribution to bring society back into balance again, locally and globally. Such programmes of intercultural dialogue between traditional and modern sciences may eventually also contribute to coevolution of classic, tribal and western scientific knowledge traditions.

Universities indeed have an important responsibility in society and a challenging road to travel on!

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Tanks and Anicuts of South India
Examples of an Alternative Science of Engineering

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Abstract

In the past several decades, the harmful side effects of science and technology have become painfully clear. This can be traced to modern science which concerns itself solely with the study of "facts" (devoid of value) and hence, its method is necessarily reductionist and vivisectionist. An alternative science of engineering must be inherently free of side effects and yield solutions/systems that would perform their stated function without unduly harming the rest of creation. There is considerable evidence that concern for and preservation of all life was the underlying primary objective of traditional science within India and without. If we are able to unearth the principles and method of an alternate science of engineering, it could be applied to present day problems and needs.

A few significant results from our study of traditional irrigation systems are presented here. Although, at this stage we do not claim to be anywhere near the long-term goal. Hampered by lack of data or any textual sources to go by, the study was based on archival search, field investigations, physical survey and flow data availability. Two examples of traditional irrigation are discussed.
1. A side weir : The Grand Anicut
2. A network of 200 tanks : Tank System on Palar river
It is heuristically argued that the oddly shaped Grand Anicut was designed to increase the sediment transport to the distributary, the Coleroon. The investigation of the tank system showed that it is located in a region of high rainfall variability both temporally and spatially. In such a semi-arid region, under unreliable rainfall conditions, the tank system diversity was found to optimize food security.

Introduction

For the past several decades, the harmful side effects of science and technology and of the rapid "development" during the 20th century have become painfully clear. Even a cursory inspection of these problems (air/water pollution, ground water depletion, deforestation, salinity ingress at river mouths because of the construction of large dams…) reveals that they are not mere accidents, nor merely due to improper use of technology, but emerging from the fundamental presuppositions of modern science and its method. As a matter of self-definition, modern science concerns itself solely with the study of "facts" (devoid of value) and its method is necessarily reductionist and vivisectionist.

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Our long-term quest is to try and rediscover the principles and method of an alternative science of engineering that would be inherently free of side effects and would yield solutions/systems that would perform their stated function without unduly harming the rest of creation. It is a project of rediscovery because there is considerable evidence that concern for and preservation of all life was the underlying primary objective of traditional science within India and without (c.f. Mayamata, 1985, Uberoi, 1984, Seathl, 1855 etc.). Thus, our interest in traditional engineering systems does not stem from a need to celebrate a "glorious past" nor from a concern for heritage preservation but from the hope that through a study of these works of engineering we would be able to unearth the principles and method of an alternate science of engineering, which could then be applied to present day problems and needs.

While at this stage we do not claim to be anywhere near the long-term goal stated above, we wish to present a few significant results from our study of traditional irrigation systems, which we feel clearly provide the impetus for further study in this direction.

The methodology adopted in our investigation is outlined below. Essentially there are two approaches. One is to read the old texts and look for principles mentioned in them. Then examine traditional irrigation networks and show how these principles were adopted in them and how effective such principles were in practice. Such an approach was not possible, given the state of the textual sources. Indeed, there is no textual source known for irrigation structures per se.

Instead, the study focussed on particular structures with a view to uncovering general principles. Traditional irrigation structures are first defined as those originally built prior to British intervention. Structures built after 1830 AD are seen to be distinctly different from those built earlier and are hence described as "modern". (It is the distinction and not merely the date that separates the "traditional" from the "modern".) The historical functioning of traditional structures and the problems encountered owing to modifications is traced where possible. Evidence from engineering literature is collected to support the hypothesis.

The Grand Anicut (Kallanai)

The first example considered here is the Kallanai or Grand Anicut. This is a stone masonry structure, about 6 m high and 330 m long, situated in the Cauvery river delta. Said to have been built in the 2nd century AD by the king Karikaal Chola, it is a side weir lying along the northern bank of the Cauvery. The Cauvery delta begins at the point where the undivided river (i.e. Akhanda Cauvery) divides into two branches, the northern branch called Kollidam and the southern branch that retains the original name, Cauvery. The Grand Anicut is situated 28 km downstream from this bifurcation. A sketch of the river in the vicinity of the Grand Anicut is shown in Figure 1.

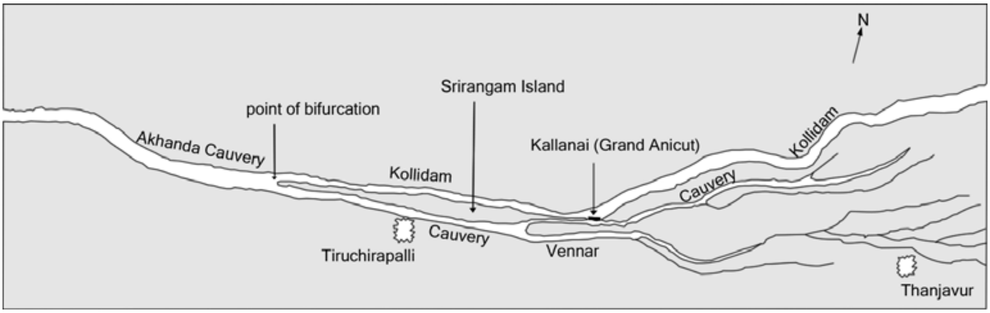


Figure 1. Map of a small section of the Cauvery as it was in 1854 AD. The section includes the beginning of the delta (i.e. point of bifurcation) and the Grand Anicut, 28 km downstream. It also includes the towns of Tiruchirapalli and Thanjavur. ***(Adapted from a map drawn in 1854 in Baird Smith, 1856.)***

The Cauvery is the primary river for irrigation in the region. Even in 1800 AD, it irrigated 6,00,000 acres[***]. The main function of the Grand Anicut was to keep the waters of the Cauvery away from the faster and steeper Kollidam (Coleroon) during normal times, while allowing floodwaters to be safely transported from the Cauvery to the sea via the Kollidam. The Grand Anicut apparently performed its function adequately for nearly two thousand years without the aid of any other structure in its vicinity.

When the British arrived on the scene in the early years of the 19th century, the Grand Anicut was in a state of disrepair owing to political upheavals in the region (the wars between 1740 and 1790 AD). There was severe aggradation[†††] in the Cauvery branch, threatening to choke water supply to the 6,00,000 acres irrigated by the Cauvery. The British struggled with the problem for decades. As one British engineer wrote (Baird Smith, 1856)

> "For nearly 25 years, from the time at which Captain Caldwell's works were completed (i.e. 1806), an incessant struggle was maintained against the increasing tendency of the river-bed to silt up –- the head and many parts of the channel were periodically cleared of deposits by manual labour – long and expensive embankments were carried across the bed of the main stream, so as to force a larger supply of water into the Cauvery branch. All these efforts however, were ineffectual – the bed continued to rise, the supply to diminish, the extent of land under irrigation yearly decreased, the revenue was falling off, and the condition of the people was visibly becoming worse and worse. About 1829-30 the crisis had been reached…"

[***] Today it irrigates about 11,00,000 acres, yet the problems of this river reach are far from satisfactorily solved.

[†††] Aggradation refers to the rise in river-bed level owing to deposition of sand there. The flow, unable to carry more sediment than its "capacity" drops any excess sediment leading to "aggradation". The opposite situation, *viz.*, "degradation" occurs when the flow is carrying less sediment than its "capacity", it then picks up sediment from the river-bed reducing the river-bed level.

To resolve the crisis, drastic modifications were made after 1830, adding hydraulic regulators upstream and downstream of the Anicut etc ##. The Grand Anicut Complex existing at present is shown in Figure 2. It is quite clear that the British engineers undertook all their modifications without fully understanding the original system. In fact, the first modification itself (done in 1806 AD) may have been to the detriment of the functioning of the structure. This was to level the top of the structure and raise it by about 2 feet.

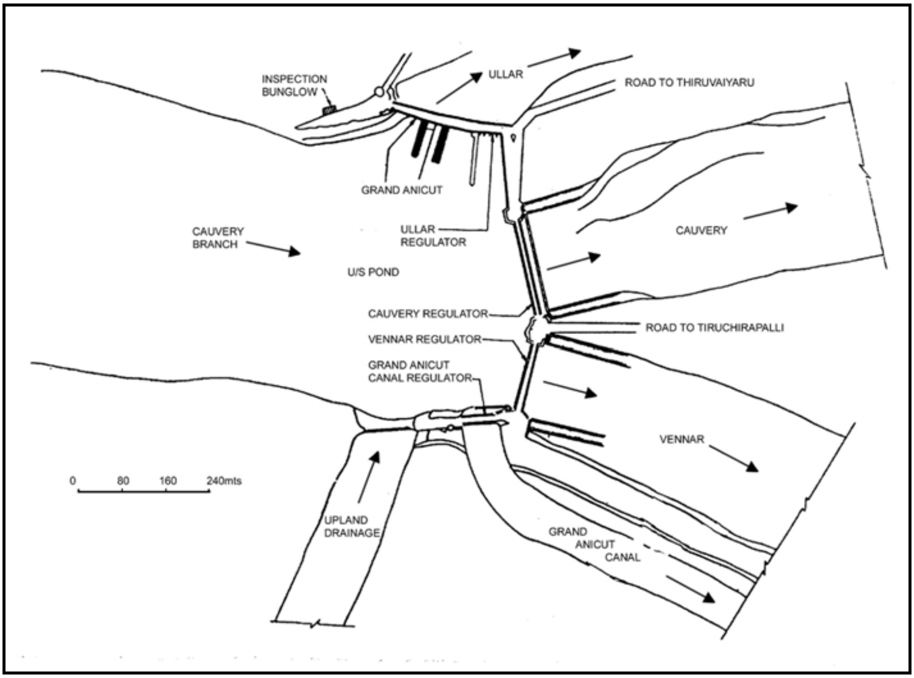


Figure 2. The Grand Anicut Complex at present
(Source: Mohanakrishnan, 1990)

Fortunately, a picture of the Kallanai prior to modifications can be imagined, from a record dating back to 1776. Peculiar features of the anicut are mentioned in the record. It was curved, i.e., "making two or three waves from one end to the other". Its crest was not level but sloping; higher at the western end than the eastern end. It had a transverse slope too, "a descent from the front to the rear… which makes in some parts a regular and smooth slope and in others irregularly by 3 or 4 steps". Lastly, "overall is spread about ¾ inch thick of a very fine and smooth chunam to prevent the water from making the smallest impression...". This plaster probably needed to be replaced every five years. Further, the front was ragged and uneven, which, however, was said to be an advantage as it "threw up a bed of sand in perpetual suspension for its defence" (Figure 3).

There have been several major alterations to the structure and river reach since 1800 when the British took over the region. Since 1934, upstream dams have controlled flows to this reach. All these have greatly changed the discharge and river condition here. As a result the importance and effectiveness of the Kallanai has changed.

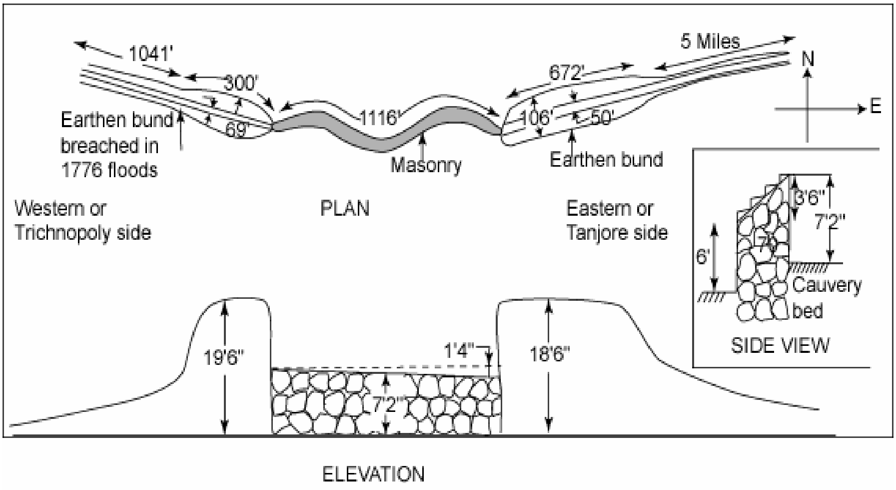


Figure 3. Plan and elevation of the Kallanai based on the 1777 report (not to scale)

These curious features may help explain the effectiveness of the Grand Anicut in the centuries prior to 1800. A heuristic argument can be made. As Leliavsky (1957) noted during tests in Egypt, the slope of a side weir influences the sediment transported over it. A hypothesis is elucidated in Krishnan (2003), but in brief, the Grand Anicut's undulating plan form and the transverse and longitudinal slope of its crest etc. transported a significant fraction of the bed sediment over the anicut during floods. Thus, the overall bed slope (from the point of bifurcation shown in Figure 1) in the Cauvery branch is increased, thereby, increasing the speed of the flow and hence its sediment carrying capacity and preventing any net aggradation.

Future work could involve modelling the "curious" features of the Grand Anicut, but it presents a very difficult condition to scale down and model. Also, data for calibrating the model are not there, given all the modifications done to this river reach over the past 200 years. Yet, this is an important, albeit complicated, example. This is because some idea of the original structure, as also some details of its performance, could be pieced together. This information is not known for any other traditional anicut. Indeed, this was the very first irrigation structure that the British tampered with in India.

A tank system

The second example concerns the Palar, a seasonal river that originates in Kolar district (Karnataka) and flows predominantly east into the Bay of Bengal midway between Chennai and Pondicherry. More than 1500 tanks have been built in the basin of this river of which the Chillapanahalli Subseries (consisting of 198 tanks) of the Ramasagara Main Series was chosen for detailed study. On the basis of long rainfall records, runoff measurements, physical survey and examining old tank registers, an analysis was made.

A schematic drawing of the tank series under study is shown in Figure 4, on the basis of information obtained from the tank registers of 1907 AD. In this figure, the

areas of the rectangles correspond to the capacities of the respective tanks and the lines indicate interconnections (inflow and outflow). As can be seen, the connectivity is quite complex and the variation in sizes is considerable. The 11 large tanks (capacity over 1 Mm^3) can hold 60% of the total storage, while the remaining 187 tanks can hold only 40%. This begs the question as to why so many small tanks were constructed.

A couple of important points can be noted from our analysis of this tank system. Rainfall and runoff data for the region indicate that the small tanks would fill up every year, while the large tanks would fill up only once in four years. The small tanks were useful in cultivating an annual rainy season (July to Nov.) crop of paddy, and once in four years, the large tanks ensured a second and very productive crop of paddy in the summer (Jan. to May). Given the variability of rainfall in the region, this arrangement appears to optimize food security. Calculations show that even assuming fairly conservative yields, a population density close to that existing in the 1980s could be supported by this traditional system. As regards maintenance of the tanks, calculations show that even the largest tanks could be desilted by the community it catered to. About 20 people from every village working for a month each year could manually desilt the tanks that fed them, even assuming a high siltation rate. Yet when neglected for decades, the tank desiltation effort becomes unmanageable, as evident today.

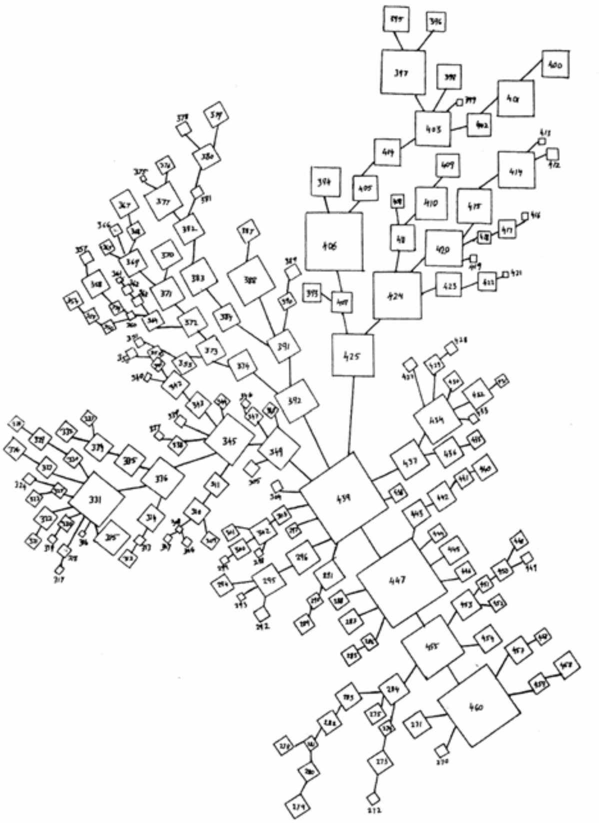


Figure 4. Schematic drawing of the Chillapanahalli Subseries showing the relative sizes of the tanks and the interconnections between them

Conclusion

The short term objectives of such a study are to understand the working of some traditional irrigation structures. The two examples discussed above have provided such an understanding. The challenges of such studies, wherein there are no texts known and when the structures themselves are greatly modified, are clearer. A key point that emerges is that "sustainability" appears intrinsic to the "traditional method". The Grand Anicut functioning for centuries together or a tank system dating back a thousand years and yet functioning are clear indicators of sustainability, especially when contrasted with "modern irrigation" with all its attendant problems.

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Concepts and Principles Used in Traditional Houses and Their Modern Adaptations in Sri Lanka

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Abstract

The architectural tradition of Sri Lanka that has continued for more than 2000 years is being carefully studied in the following three ways:

- *Studying literary sources such as ancient chronicles, silpa texts, historical records etc.*
- *Analyzing and understanding archaeological remains of the past 2000 years*
- *Studying the architectural practice prevailing in the country*

It is evident that architecture was the result of an understanding of the performance of materials available in the surrounding environment, an understanding of the climate and environment and the development of mathematics and technology, interwoven with beliefs and practices, moulded with aesthetics and creativity.

This paper intends to discuss the tradition of designing and building houses for the common man and not monumental architecture. Sri Lanka is a small island but environmental and topographical differences have produced distinctly different types of housing in the different provinces of the country. These house designs reflected the architects' knowledge and understanding of nature and the environment and the solutions they found, in the simplest manner, for the issues that they faced.

It was found that traditional practices were preserved and continued by repetition. In every step in the process of building a house, varied aspects of tradition including religion and astrological beliefs were reflected.

During this early period in history, the rate of change faced by society was minimal, but with European influences, urbanization and advancements in technology, the demands and practices of society have changed drastically. The paper will discuss how modern houses are built in keeping with traditional beliefs and practices.

Tradition is generally considered as the transmission of customs, beliefs and practices from generation to generation or anything that is so passed on. It can also be interpreted as the wisdom of the past. In the process of man's evolution, over many generations, he understood nature and the environment where he lived, struggled for survival and existence, searched for solutions to overcome the issues and problems he faced, retained the solutions with continuous improvements and adaptations, and these practices have given rise to traditions. It was a wealth of knowledge, simple in approach, and it continued from generation to generation fulfilling the needs of each. Traditions were never static; they changed with time, fulfilling new demands every time knowledge was acquired and new influences were faced.

The practices and the products that failed to fulfill the new requirements or demands died with time in the evolutionary process; what supported the survival of a healthy society continued as tradition. Changes that took place in the past were gradual and not in a leap-frog form. The external influences faced by society in the past were not so strong and were drastically different to those found today. It is evident that in the current social process people are losing the heritage that was passed down as tradition because of ignorance, resulting in a conflict or imbalance between

the spiritual, human qualities of man and material life. A proper understanding of the spirit of the tradition and its values can bring simple solutions to modern day issues and can support the survival of a healthy society.

The house is the defined place of activity and identity of a family. A house is always identified with a family, and at the same time, a family is also identified with a house. Therefore, it is obvious that a house provides many more things other than only shelter. It is the place of living. A traditional house provided not only shelter but also comfort, prosperity, happiness, health, dignity, identity and protection. It is also interesting to understand how people made a house structure that fulfilled multiple requirements and technological performance as well as social and mental satisfaction. Therefore, traditional houses are different from civilization to civilization, country to country, culture to culture, province to province and individual to individual but satisfy the basic requirement as a place of living.

In the Sri Lankan context, many studies were carried out to understand the provincial and cultural variations found in traditional houses in all the provinces of the country. These revealed that people were sensitive to their living environment and have understood the behaviour of nature. As a result, their physical adaptations have created simple solutions to the problems they faced, satisfying their requirements. The resulting structures of different forms and shapes have exhibited provincial identities. But a study of individual houses showed a lot of similarities in the final product as the synthesization was governed by traditional practices and beliefs.

A crow living in a rural environment builds its nest on a tree using the twigs, leaves and fibrous materials it finds in the locality. Similarly, a crow living in a busy crowded metropolitan area builds its nest on a telephone post using wire, nails and metal and plastic pieces, fulfilling the same requirement. Man also has followed the same path in building his houses using materials readily available in his immediate environment, resulting in interesting variations in their plan and form.

The changing socio-economic situation and urbanization have greatly influenced the aspirations and requirements of people in both urban and rural areas. They have built and are continuously building houses in this changing socio-economic environment. It is interesting to note that people have continued to follow traditional design principles and traditional beliefs in this modern context by adapting them in an aesthetically pleasing, functional and socially acceptable fashion.

Today, the key issue faced by people is to find ways of facing and adapting to fast changing technological achievements and the physical environment that they live in. Architecture is one major field that needs to cater to these fast moving changes and new demands. Urbanization is advancing fast, new infrastructure and services are being added on, new technology brings information from the world to the doorstep, but in spite of all this, what is needed is for people to live happily in comfort and with satisfaction.

In the past, traditional indigenous knowledge provided simple solutions to the problems that human beings faced. Even though some of the situations that man is living with now are different to those in the past, his aspirations, desires and greediness have not changed. Therefore, it is desirable to understand the philosophy behind the construction of residential buildings and their practical use.

For example, in the past, the tradition was to build a house on open spacious land so that it got plenty of sunlight and had cross ventilation and lush vegetation.

Today, such land is not readily found and a block of land available for building a house may only be 150 to 250 square metres in area. But Sri Lankan architects have managed beautifully to find ways to maintain the traditional style by creating internal open courtyards to provide the required natural light and ventilation. The quality of the space thus created has brought nature into the interior of the house, where in peace one can experience the rain, the changing quality of sunlight, the blowing wind, the greenery etc. Here, the philosophy of the tradition has been creatively utilized in building houses that provide an open feeling and are as aesthetic as the traditional courtyard house.

The open verandah found along the façade and around the courtyards of traditional houses that served as a buffer space between the inside and the outside space, both environmentally and socially, has been well incorporated and adapted in every well designed modern house. The verandah was used as a sitting area for outsiders who were not to be directly entertained inside the house. In modern houses, when the outside sitting facility could not be provided because of site restrictions etc., the space immediately available near the main door was adapted or arranged with furniture in order to satisfy this social requirement.

As the demand for construction materials increases, new materials have entered the market while the availability of traditionally used construction materials is gradually reducing. But clay bricks, clay roofing tiles and terracotta floor tiles are still popular and in use in house construction. With the improved quality of these traditional materials, they have become more expensive than their modern substitutes and, today, it has become a fashion to use traditional building materials in house construction.

Whatever the social standing, however modern the house, all Sri Lankans are conscious of and particular about many traditional practices such as ensuring the main door faces the right direction; ensuring an odd or even number of doors and windows, depending on what is required; ensuring that no walls cross each other directly; ensuring that the kitchen is appropriately located; ensuring that the ridge rafter is positioned properly in relation to the centre of the door opening etc. in order to prevent ill luck from falling on the household.

The horoscope of the owner of the house continues to play an important role. All important milestones in the construction of a house such as laying the foundation, installing the main door, starting the construction of the roof, stepping into the new house are all done at the auspicious time given by an astrologer to bring good luck to the occupants of the house. Further ceremonies are also carried out to obtain religious and spiritual blessings to nullify any possible evil effects on the house and the land. These practices and beliefs bring mental satisfaction, confidence and hope to the household.

As a result, the Sri Lankan home has become a product of modern architecture synthesized with tradition and beliefs. All efforts have been made to maintain the essence of the traditions in their own way, but this has resulted in a departure from the overall simplicity found in the traditional house. Modern day architects have been inspired by tradition but have not directly copied it. Traditions can be properly adapted for modern use only with a correct understanding of the philosophy and the spirit behind the traditions. It was found that people have learnt from tradition to satisfy their day to day requirements in this modern world.

New Physics and Old Sciences

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Abstract

Modern physics is a specially restricted science, which studies nature as an external world of space and structure. Here, scientific theories work through calculation. They work by calculating objective results, which are tested and applied through external instruments and machines. The testing and the application are thus standardized mechanically by specifying the construction of external instruments.

But this external standardization does not apply to our living faculties of personality, in which we experience an expression of consciousness. Accordingly, in modern physics, the living faculties of scientists can only be used for the intuitive creation of theories. Once the theories have been formulated, their testing and application must be mechanical, through mechanically standardized instruments. This is the special restriction of modern physics. Its application is restricted to the external world in a way that excludes our living faculties and their expression of an underlying consciousness.

The older sciences are broader in their general approach. In their study of nature, they include our living faculties of action, thought and feeling. They thus conceive of nature as the realm of all activities that we experience. Here, nature is taken to include not just an external world, but also all the activities of life and mind that we experience as expressing consciousness. Our living faculties of personality are very much included here, and so they play a major role in the testing and the application of the older sciences.

This paper asks how nature is conceived in the older sciences so as to include both world and mind. And it goes on to ask how scientific theories work through education: by using them to cultivate and clarify our living faculties towards a subjective standardization of impersonal knowing.

Calculation and education

What we now call "physics" is a specially restricted science. It studies nature as an external world, where objects are related into structures. In modern physics, these structures are described mechanically – as though they were carefully engineered machines that function in a calculated way, with results that are reliably predictable.

Because of this mechanical approach, modern physics works essentially through calculation. Its theories are designed primarily to calculate predicted results. And the results are then tested mechanically, through external instruments and machines, in a world of space and structure.

In the last few hundred years, the success of modern physics has been obvious and spectacular. So much so that it has come to be regarded as a model which all other sciences should follow. But here, I would say, there is a problem. Sciences do not only work through *calculation*, as exemplified by modern physics. They work more essentially through *education*, as exemplified by the much older science of linguistics.

In fact, the success of modern physics is achieved at the cost of an inherent restriction. What modern physics studies is a world that excludes our minds. The older sciences consider nature in a broader and deeper way. In their approach to nature,

they include both the external world and the expression of consciousness that we experience in our living faculties of sense and mind.

That broadening requires a shift of emphasis, from calculation to education. In particular, the shift can be seen by comparing modern physics with the old science of linguistics, as shown in Table 1.

Table 1. Modern physics and linguistics

	Modern physics	***Linguistics***
Primary and direct use	To *calculate* predictions and achieve objective results	To *educate* living faculties of expression and understanding
Secondary and auxiliary use	To *educate* intuitions that inspire successful theories and their useful application	To formulate rules for *calculating* correct word forms and use
Meaning of words and symbols	Defined considerably through artificially agreed convention, like names being used as mere labels to identify places on a map	Based essentially on nature and history, like words that evoke a meaning through their shape of sound

The primary and direct use of modern physics is to calculate predictions that will enable us to achieve objective results. But indirectly, modern physics also serves to educate our scientific intuitions, from which successful theories are inspired.

In classical linguistics, the emphasis is just the opposite. Here, in linguistics, the primary and direct use is educational. It is to educate our living faculties of expression and understanding. It is through these educated faculties that we are able to speak and listen. And they work best when we use them naturally and spontaneously, without the cumbersome interference of calculating what we are going to say or what we may expect to hear. Linguistics does have calculating rules – of pronunciation, grammar and vocabulary. But these rules are no more than artificial aids to learning. They only help indirectly to cultivate our living faculties of speech.

So the old science of linguistics is directly tested and applied through the educated faculties of its practitioners. This direct use of living faculties is quite legitimate, because the old linguistics looks at nature in a broader way than modern physics does. In that broader approach, nature is taken to include our minds and their expression of a subjective consciousness.

Our living faculties are thus included in the nature that is studied by old sciences. These living faculties are studied as expressions of an underlying consciousness to which we may reflect in our minds. Through that subjective reflection, these faculties are educated and controlled so that they may be accurately used in the testing and the application of old sciences.

In short, the old sciences make use of our living faculties, whereas modern physics is restricted to the use of external instruments that are mechanically standardized.

- In modern physics, a theory must be tested through mechanical instruments. It is not legitimate to test or to apply a modern physical theory through living faculties that are outside the field of study, which does not include an expression of

subjective consciousness. Modern physics has no proper way of standardizing or controlling our living faculties, and so they can only be used for the intuitive creation of theories that must be tested and applied mechanically.

- In the old sciences, theories do not work just mechanically. They work more delicately and more subtly, through a subjective reflection into mind. The reflection educates our faculties – as do the instruments that sciences may use to investigate what is true and to apply what has been found.

Levels of expression

However, if our living faculties are to be used in science, then they too need to be described and analyzed. They work through different levels of experience as consciousness becomes expressed in the process of our lives. An old analysis comes down to us from Sanskrit linguistics. A summary is shown in Table 2. It describes three levels rising from an underlying ground.

Table 2. Levels of expression

Body	**Space**	**Coexisting points**	**World of objects**	**Elaborated structure, perceived by body**
Mind	Time	Replacing moments	Succession of states	Mediating process, conceived by mind
Consciousness	Causality	Continued consequence	Assimilating capability	Silent seeing, at the depth of insight
	Knowing in identity			

- The uppermost level is our outside world of space and structure, seen through our bodies. Here, meaning is articulated, in symbols that are joined into elaborated structures. This level is called *vaikhari*.
- The second level is a succession of passing states, which each of us experiences in time. For every one of us, the world of objects is conceived in this way, through a succession of replacing states that come and go in the mind. Each moment brings a state of mind, and as each moment is replaced by other moments, every state of mind becomes replaced by other states that follow on in time. Here, meaning is drawn out and interpreted as our feelings and our thoughts keep on expressing consciousness and reflecting back to it. A changing stream of mind thus mediates between our inner knowing and the objects we perceive. This mediating level is called *madhyama*.
- At the third level, we experience a continued consciousness, of cause that carries on through time. Such cause must carry on unmanifest, as a quiet potency implying tacit aptitudes and capabilities that may be manifested later on. Here, continuity is carried by a silent seeing at the depth of insight, where changing states of surface mind are taken into lasting knowledge. Here, consciousness appears somewhat paradoxically, as a silent and unmanifested knowing, which is

often described as the "unconscious". This is an inner level of invisibly continued seeing, called *pashyanti*.

- Beneath all changes and all continuities, there is an underlying ground from where our knowing is expressed. That ground is a consciousness whose very being is to know. It is only known in identity, by returning to what it is. There, consciousness is realized in its own being. That final ground is called *para*, which means "beyond" or "ultimate".

Nature and consciousness

When nature is conceived as an external world, we think of our experience as personal. This way of thinking is illustrated in Figure 1. Here, each person is a knowing island surrounded by a known world. As a person looks around, many things are known outside through information taken in. So, for each person, a process of knowing keeps on taking place inside. And what is known is a surrounding world made up of many things.

But when our minds are taken into account, we can think of our experience in a rather different way. At any given moment, a person's mind sees something in particular. So, a particular object appears at the front tip of attention. But underneath, other things are understood at the background of experience. That background is the depth of our experience. It is the depth where consciousness continues while objects appear and disappear, at the focus of attention.

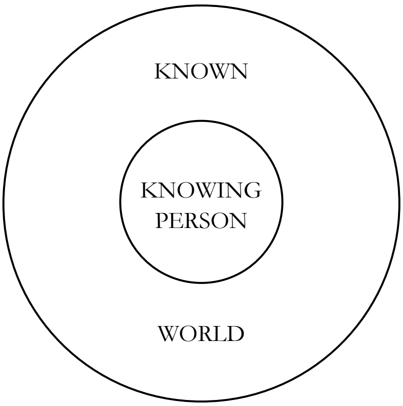


Figure 1. Knowing island

From that underlying background, attention is drawn up so as to focus on the object that appears. This focusing is shown in Figure 4. As an object appears in the mind, it expresses understanding from a continued background of underlying consciousness. The expression rises up through feelings, thoughts and actions that have turned attention to this particular object so that it gets to be perceived in a narrow focus at the surface of the mind.

As the object is perceived, its perception is reflected back – by observing the object's form and relationships, by naming the object and interpreting its meaning and by judging its quality and value. The perception is thereby assimilated into a new state

of understanding that is carried on in time – by absorption into underlying consciousness.

Then, from the new state of understanding, further feelings, thoughts and actions rise; thus, turning attention to further objects that come into appearance and are assimilated into understanding. This cycle of expression and reflection keeps on mediating back and forth between the changing objects that appear and the background consciousness that carries on beneath. It is only thus that we can learn, as a variety of objects come and go, in the course of continuing experience.

If you look again at Figure 2, you will see that it divides our experience into two. At the bottom of the diagram, below the horizontal line, consciousness is shown, continuing through change. Above the horizontal line, what is shown is a nature that includes all the actions in the mind, along with each object that is seen in the world.

Here, nature is not just an external world. Instead, it includes all activities, both in the world and in our minds. The world outside cannot show itself to anyone. It is always shown through mind, in anyone's experience. But, where nature is taken to include our mental activities, it can be conceived to manifest itself. It shows itself to consciousness, in everyone's experience. That is the old conception of "nature" and "consciousness".

In that old conception, consciousness is not an activity of mind. Instead, it is a pure witnessing, unmixed with any mental or sensual or bodily activities. It is a knowing light that is completely actionless. As nature shows appearances, they are illuminated by the light of consciousness. And consciousness illuminates itself by merely being what it is. In short, nature is the realm of all changing activity. And consciousness is a pure knowing that remains unchanged, quite unmixed and unaffected by the changing acts of nature.

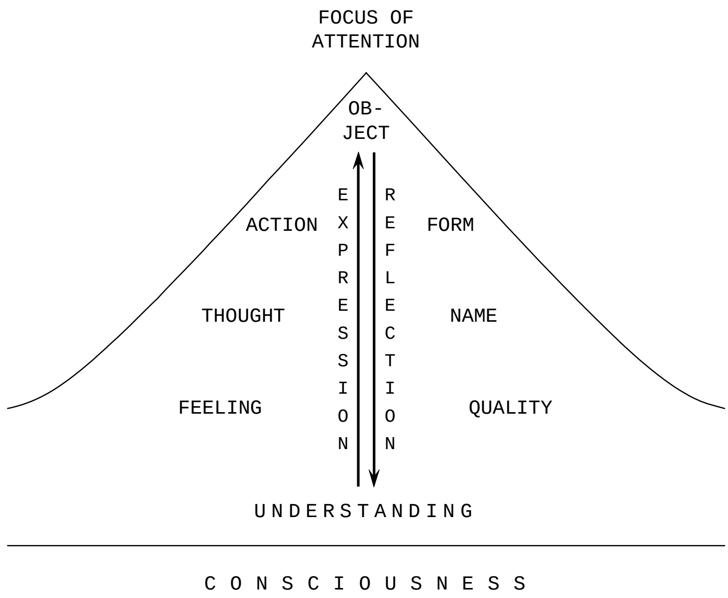


Figure 2. Learning from experience

Living energy

But then, what is the relevance of consciousness? What is the practical effect of its pure knowing in our personalities and in the world outside? This effect is described by the old concept of *prana* or "living energy". That is the energy that we experience in our living feelings, thoughts and actions, as they express the consciousness that underlies them.

That is an energy of inspiration, which arises from within. It inherently expresses value and meaning and purpose, in our personalities and in the world. And it can only be understood by reflecting back within – through forms that we observe, through meanings we interpret and through qualities that we appreciate – as we return to underlying consciousness, where the reflection is absorbed.

It is that energy that drives the process of experience in our lives. Unlike the energy of modern physics, it is not a transacted commodity, which is passed on from one object to another. Instead of being transacted by objects, it is recycled out and in – as it arises from underlying consciousness and is returned there again.

Accordingly, the older sciences conceive of "life" in a way that is rather different from modern physics. The difference is summarized in Table 5.

Table 3. Life and energy

As seen externally, through mechanical instruments	As seen by reflective questioning, into our living faculties
• Life is a special property of complex behaviour, which emerges in bodies that are similar to ours. • The similarity includes mechanically constructed senses – which function like our eyes, our ears, our noses, tongues and our skin and flesh. • And it further includes a mechanical co-ordination of these senses and other body parts, through some mechanisms that work like our nervous systems and our brains.	• All nature's functioning is understood by reflecting back to a common principle of consciousness, which each of us accesses by reflecting back within. • Wherever anyone may look, whether life is seen or not depends on *how* one looks. Looking outwardly, at objective structure, no life is ever seen. Reflecting back to consciousness, whatever is seen expresses it and is thus found alive. • Seen thus, all nature is essentially alive.
• In the external world, energy acts mechanically, from one object to another. Each object is thus acted upon by influences and constraints that are imposed from outside. • This is a quantitative energy, which is measured by external instruments and transacted between objects and persons. This energy is measured out and used for objective purposes – of achieving desired objects in the world.	• As nature functions, a living energy arises from within, acting of its own accord. That is the energy called *prana*. It does not act from any object in the world. Instead, it is inspired from within – as it arises of its own accord from an inmost ground of consciousness. • That *prana* is the qualitative energy that expresses value, meaning and purpose in our living activities – as they arise from the consciousness that knows them.

Five elements

If you look back, once again, at Figure 2, you will see that it shows nature at five levels (in the broken triangle that is formed by the three lines). First, there is a level of objects – where our limited attention gets focused. Second, there is a level of action and form – where action turns attention to objects and our experience is given shape. Third, there is a level of thought and name – where thoughts direct our actions and names are used to describe the forms that we perceive. Fourth, there is a level of feeling and quality – where feelings motivate our thoughts and acts through an intuitive judgement of qualities and values. And fifth, there is a level of understanding – which expresses knowledge and assimilates what has been learned.

These five levels form a progression, from the gross to the subtle. This is a progression that has long been conceived, somewhat metaphorically, as the old "five elements". An interpretation is summarized in Table 4.

Table 4. Five elements

Traditional element	Level of appearance	Examining instrument	Scientific disciplines
"Earth"	Pieces of matter	External body	Modern physics
"Water"	Transforming energy	Organic faculties	Biological sciences
"Fire"	Meaningful information	Conceiving intellect	Culture studies and humanities
"Air"	Conditioned character	Intuitive judgement	Psychology and meditation
"Ether"	Continuing existence	Reflective reason	Philosophical questioning
Unchanging ground of reality and consciousness			

- At the level of "earth", differentiated pieces of matter are perceived through our external bodies, as assumed by the calculating theories and technologies of modern physics.
- At the level of "water", an activating and transforming energy is observed through our organic faculties, as cultivated and developed in biological sciences that seek to harmonize our microcosmic lives with their containing macrocosm.
- At the level of "fire", meaningful information is interpreted by our conceiving intellects, as educated and clarified by culture studies and the humanities.
- At the level of "air", a qualitative conditioning is evaluated by intuitive judgements that are exercised and expanded in psychology and meditation.
- At the level of "ether", continuing and common principles are investigated by the reflective reasoning of philosophical enquiry, which turns its questions back upon assumptions that have been taken for granted.

But in the end, all sciences are built on common ground, beneath the change and difference of appearances. That ground is the basis on which scientists communicate. On it depends all scientific standards, of accurate testing and of meaningful reference.

Institutions and the individual

But, on what common ground do we build our various sciences? To what common standards do scientists refer, beneath their different personalities? And how do they use those standards to achieve an impersonal knowing, which different people can communicate and share?

In modern physics, the common ground of science is considered only as an objective world. In this world, all standards depend on external objects and constructions that are outwardly identified by organized institutes of scientific teaching and industrial technology. Thus, modern physics is primarily *institutional*. Its standards are maintained externally by organized institutions in society.

However, in the older sciences, a further consideration is investigated – by reflecting the investigation back beneath assumed beliefs, towards a ground of knowing that is shared subjectively. That reflective investigation seeks a truth that is at once subjective and impersonal. The truth thus sought may be called "spiritual". It is a ground reality of a purely knowing spirit, beneath all differences of physical and mental personality.

Accordingly, the older sciences include the investigation of a spiritual reality, in their testing and their application. Most older sciences are therefore partly spiritual. They partly seek objectives in the outside world and partly investigate subjective principles of the knowing spirit. As a result, the older sciences have something of a different character from modern physics.

To get some sense of this different character, it may help to consider an ancient science that is fully and completely spiritual. In India, that science is called *advaita Vedanta*. In ancient Greece, it was called "philosophia" or "love of knowledge".

As the Greek name implies, that science of philosophy is purely educational. It does not seek to calculate results or to achieve objectives in the world. It only asks for a true knowing of impersonal reality. And it asks subjectively, by reflecting back into pure knowing, beneath all the assumptions that we make in our pictures of the world.

As that questioning proceeds, it cannot end with any standard that has come to be instituted by society. All such standards must be opened up to questioning – in search of an inmost standard that is ultimately shared by everyone, beneath all personal and social and cultural constructions.

Accordingly, the search is ultimately *individual*. It seeks a common standard that each individual must find for herself or himself, beyond all institutions in the world. As an individual learns the science of philosophy, the learning cannot be just institutional. It must in the end be fully and completely individual, under the guidance of an individual teacher.

Today, we tend to think of philosophy as an academic and theoretical subject, which is taught at schools and universities. But this is not the old science of philosophy as it has been practised and handed down from ancient times. That discipline is quite beyond the teaching or the jurisdiction of any institutions that are organized. It is a discipline whose emphasis is inward and individual, in the extreme.

As we consider the sciences in general, it may help to locate them in a range that extends in between the extremes of modern physics and reflective philosophy.

- Modern physics is the most suited to institutional teaching in schools and universities and to the industrial organization of engineered technology. It has

therefore profited the most from modern communications and the economic developments that they have made possible. But there is an inherent weakness here. This engineering approach achieves particular results, but it does so at the expense of the environment as a whole. Its narrow calculations are insufficient in themselves. To use them wisely, they need a broader and a deeper education of our living faculties.

- In the biological sciences, there is of course a useful application of engineered instruments and machines. But, in the end, these sciences work more essentially through the educated faculties of their living practitioners, as for example in the sciences of medicine. It may be noted here that modern "biophysics" and "biochemistry" are not truly biological. They are no more than mere extensions of modern physics, with no truly biological conception of a living energy. For a more genuine biology, we have to consider older sciences that have come down to us as living disciplines today. These older sciences include not only medicine, but also astrology and alchemy and various ritual disciplines that are essentially beyond the scope of modern physics.
- Culture studies and humanities work in a way that is clearly more educational than calculating. Their use of information clearly benefits from modern communications and from the instituted organization of schools and universities and libraries. But here, in the humanities, the teaching and the application are more delicate than in modern physics. They depend far less on certified results in laboratories or clinics or other institutions. What is more essential is what is individually learned by the individual teacher and the individual student.
- In psychology and meditation, the teaching and the application are more inward still. They are meant for an inward journey into the mind, a journey that is meant to purify an individual student's character.
- And finally, when it comes to reflective philosophy, there is a basic questioning of what it means to be an "individual". As a matter of ingrained habit, we tend to identify each individual as a physical and mental person. But there is a confusion here. This word "individual" comes from the Latin "individualis", which means "indivisible". That is its essential meaning. It refers to an inner unity at the centre of a divided personality. The old sciences are intended to reflect back there, in search of a knowing that is free from the bias and distortion of our physical and mental partialities.

It is of course an open question as to how this individual emphasis can be maintained, in the face of larger scale commercial pressures in the modern world. I would say that it requires a more independent-minded spirit of enquiry. A spirit that remains unwilling to be compromised – as it returns to a very old investigation, which has kept on asking how and where each one of us is truly "individual".

How to Make India a Knowledge-based Society?

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I. Leveraging our traditional wealth

India has had an unbroken tradition, built over five millennia, of unusual varieties of arts, crafts and practices that collectively go under the name of "traditional and cultural knowledge". Some of this knowledge is documented, while the rest of it is not adequately documented; further, where documentation exists, in many cases, it does not allow one to immediately cull out the information that one would need today to optimally utilize the traditional or cultural knowledge in various areas. In spite of valiant efforts by the Government of India after Indian independence some six decades ago, and the equally important efforts of a number of highly talented, knowledgeable and committed individuals, the fact remains that, in its engagement with mediocrity, India has far from optimally utilized its traditional knowledge for social and economic gain. Not only has this knowledge the potential of providing full employment or additional employment to over 200 million people, it can also generate a revenue for the country of over 600,000 crores of Indian Rupees (one million US dollars roughly equals Rs.5 crores) and can provide products and services of great social and economic value, thus enhancing the prestige of the country. Further, the traditional wealth of India has the potential of serving as a vehicle for the creative abilities of Indians in diverse fields, generating new kinds of tourism and providing opportunities for research in new areas, besides, of course, adding to the repertoire of knowledge for the peoples of the world. The fact is that all this is possible, and it is only when that happens that India will be an effective knowledge-based society, for it would have then encompassed both modern and traditional knowledge and married the two where necessary. It is hoped that the National Knowledge Commission will work out a plan to accomplish the above objective.

I will now make some comments on the following areas of our traditional knowledge:

a. Plant-based drug formulations
b. Traditional agricultural practices
c. Traditional water-harvesting practices
d. Our creative and cultural traditions
e. Food in regard to the indigenous varieties available
f. Some new aspects of tourism

However, before I talk about the above, I would like to mention some principles and basic premises that relate to traditional knowledge (from its documentation to its use) that we must accept and adopt. This statement of "principles and basic premises" was worked out at a meeting on traditional knowledge under the auspices of the National Knowledge Commission in Hyderabad on 5th December 2005. The participants in this meeting included Prof. Anil Kumar Gupta of the Indian Institute of Management, Ahmedabad; Dr Darshan Shankar of the Foundation for Revitalisation of Local

Health Traditions, Bangalore; Mr. Rajiv Sethi, Vice Chairman, Indian Planning Commission's Task Force on Creative Industries, New Delhi; Dr A. K. Gogai of the Indian Council of Agricultural Research, New Delhi; Prof. M. P. Ranjan of the National Institute of Design, Ahmedabad; Mr. Neetu Loond of Ishwar, an Indian textiles corporation, Paris; Mrs. Chandana Chakrabarti of the National Knowledge Commission and me. The above group felt that the following principles and basic premises must be recognized and followed when commercializing traditional knowledge.

1. In all commercialization of traditional knowledge, there must be equity in respect of the distribution of profits. Thus, the producers or the traditional keepers of the knowledge must be considered as equal partners along with others in the commercial exploitation of traditional knowledge. A code of fair trade practices in this area must be evolved by the designated organization.
2. It must be recognized that traditional knowledge does not need to be collective; it can be with an individual. Similarly, it should not be taken as being static. It must be recognized that innovation takes place constantly even in what we label as traditional knowledge.
3. Where a marriage of traditional knowledge with what is commonly perceived as modern knowledge is likely to yield better results, it should be ensured that the traditional knowledge component is not lost sight of, either in practice or in publicity.
4. Both tangible and intangible variations in any traditional knowledge item, stemming from underlying traditional taxonomy, must be recognized.
5. Where traditional knowledge comes from identifiable groups or individuals and is not in the public domain, prior informed consent must be obtained from the contributors of the traditional knowledge or innovation.
6. A legal framework should be created for establishing proprietary rights for traditional knowledge holders – be they individuals or a community.
7. A system should be set up for urgent scientific investigation of traditional practices, in various places including survival strategies, for which there is strong prima facie evidence.
8. The definition of work for employment purposes must include all activities that relate to the use and application (not just manual but also mental) of traditional knowledge.
9. A system should be created for the support of those who are involved in the formal transmission of traditional knowledge – especially women and older people in communities where young people have been migrating to urban areas in large numbers.
10. A system should be set up that would provide incentives for inter-community transmission/transfer of traditional knowledge to ensure that the knowledge is not lost – remembering that knowledge multiplies when shared and decays when kept secret or confidential.
11. The results of all research and development based on traditional knowledge must be shared with the providers of the initial knowledge package.
12. Whatever infrastructure is created to document, standardize, validate and/or commercialize traditional knowledge, it must be cross-sectoral and cross-ministerial; the system set up must operate in a mission mode with cross-sectoral

and cross-ministerial powers, for traditional or cultural knowledge is almost always cross-sectoral.

I will now deal with the use of traditional knowledge in the areas of plant-based drugs, traditional agricultural practices, traditional practices of water harvesting, our creative and cultural tradition, food and tourism, in this order.

II. Plant-based drug formulations

There seems to be little doubt that if we did not have any cures for any of the ailments with which we have suffered since we appeared on our planet, we would be extinct by now, just as, if we had always had all the cures we have today, the world population of today would have been reached several millennia earlier. The most likely ways of treating ailments in ancient and mediaeval human history would have been plant-based drug formulations, which exist virtually in every culture around the world. In fact, some of the effective drugs we have today are derived from such traditional formulations. Examples would be quinine, reserpine, vinblastin, and artimesin that have come to us from Latin American, Indian and Chinese traditions. An example of a plant-based drug formulation that does not consist of a single chemical entity like the ones mentioned above but that is an ethical (that is, prescription) drug in several parts of the world, including the western world, is Liv-52 for liver disorders, marketed by the Himalaya Drug Company of India. However, just as one can be sure that at least some of the traditional plant-based drug formulations must be effective, one can be equally sure that all of them are unlikely to be as effective as has been claimed, for the simple reason that the practitioners of traditional medicine that use such formulations claim to be able to cure virtually every ailment with plant-based drug formulations, which even the practitioners of modern medicine do not claim to be able to do.

The advantages of plant-based drug formulations in comparison with the conventional drugs used in modern medicine are many. They are far cheaper to validate and produce; they would, therefore, cost the consumer much less. And their lack of toxicity has been established through centuries of usage. Further, their manufacture would be totally non-polluting and environment-friendly.

There are, perhaps, some 40,000 unique traditional plant-based drug formulations available in the country in the documented Ayurveda, Sidhha, Unani and Tibetan systems of medicine and in the undocumented tribal systems of medicine. They need to be (a) appropriately documented, using modern information technology, in such a way that we can retrieve answers to as many questions as possible from the computerized data; (b) prioritized for further work on the basis of stated criteria; (c) standardized to obviate variations in the chemical constituents on account of soil or climatic conditions; (d) validated using, first, *in vitro* techniques and, then, the usual techniques commonly used for the validation of drugs, including clinical trials; and then (e) manufactured and marketed. All this should be done using good laboratory practice, good clinical practice, and good manufacturing practice (GLP, GCP and GMP). I believe that at least 4000 out of the 40,000 plant-based drug formulations mentioned above will be found to work and be marketable, if tested systematically.

A detailed project outlining the above and giving a detailed financial analysis has been prepared. It projects marketing 100 tested and validated formulations over a

period of 10 years, with an investment of a few hundred crores, which should at the end of 10 years lead to a turnover of Rs.10,000 crores per year with a net profit of more than Rs.5000 crores (one billion US dollars), at the prices of the year 2000. India has the capability, including infrastructure, of implementing ten such projects in the next 20 years. This would be significant in view of the fact that less than 35 new chemical entities (NCEs or new drugs) have been added every year in the last 10 years to the repertoire of drugs in the modern system of medicine, with each new drug costing on an average one billion US dollars (Rs.5000 crores) in research and development. The above number has been decreasing over the years with only 20 NCEs being approved in 2001.

Two major initiatives have taken place recently in India in regard to the documentation of traditional drug formulations and the plants used in such formulations. One initiative has been taken by the CSIR (Council of Scientific and Industrial Research, the premier federally funded scientific research agency in the country) in which they have attempted to document the formulations. The second initiative has been taken by Dr Darshan Shankar, who belongs to a well-known and respected NGO, the Foundation for Revitalisation of Local Health Traditions, in Bangalore. Dr Shankar had earlier done a superb job of documenting over 7000 plants (out of, perhaps, 10,000) used in traditional plant-based drug formulations in India. He is now documenting the formulations themselves. Documentation of formulations in a way that we can use them today poses several problems, especially of language equivalence. However, ways and means of overcoming this problem have been worked out. In summary, the first step in marrying traditional knowledge with modern technology has been taken – a marriage that has the potential of augmenting substantially, rapidly and at much less expense our repertoire of drugs. Indeed, more than 50% of the new drugs of tomorrow (by 2025) may well be plant-based drug formulations that have been standardized and validated, and India can make a major contribution in this area.

III. Traditional agricultural practices

The Indian Council of Agricultural Research (ICAR) has recently brought out a series of volumes (ICAR, 2002, 2003, 2004) that document 40,502 traditional agricultural practices, out of which 86 have been validated and 38 cross-validated as of writing this article. In addition, there is a similar documentation of such practices by Dr Anil Gupta of the Indian Institute of Management in Ahmedabad. Many of us believe that the following should be done to ensure that validated traditional agricultural practices find a place in today's agriculture around the world and add substantially to either economic or social gain:

- A consolidated, co-operative system of documentation of such practices should be set up, appropriately computerized and indexed, to which anyone can contribute and that anyone can access.
- The cross-validated practices mentioned above should be commercialized and an appropriate mission set up for this purpose by the Government of India. However, we should keep in mind what I have already said in Section I that before the above commercialization takes place, appropriate consent from those who contributed to the practice (individuals or communities) should be obtained

and a system set up for fair sharing of the profit as a result of such commercialization.

- A set of strategies for validation should be worked out. For example, one should be able to use and encourage expert farmers to be a part of the validation process. They should be appropriately supported with adequate staff.
- An appropriate venture fund that would support the above-mentioned validation should be set up.
- The above process of validation should not be confined only to what has been documented till now. It must be recognized that innovation by farmers, even the illiterate ones as is the case with many farmers in India, continues to take place all the time. Such innovation could be in areas as diverse as new agricultural implements, pesticides, veterinary medicine, animal and plant growth regulators, food processing and so on. A nation-wide system should be set up that will ensure that all such innovations are fed into the system of documentation mentioned above.

An example of an area where traditional agricultural practices are already poised to make significant contribution in India is organic farming using traditional practices within the framework of a modern scientific paradigm.

IV. Traditional water harvesting

Detailed information on traditional modes of water harvesting is already available in a book authored by the late Anil Agarwal and Sunita Narain who is at present Director of the Centre for Science and Environment (CSE), New Delhi. (Sunita Narain is a winner of the World Water Prize; CSE, under her leadership, was the organization that tested soft drinks, such as Coca Cola and Pepsi Cola and brought out that they were contaminated with unacceptably high levels of pesticides. Earlier, CSE, through a decision of the Supreme Court of India, was responsible for all public transport in Delhi shifting to compressed natural gas (CNG) as the fuel, leading to a dramatic reduction in air pollution in that city.) The book is a superb documentation of traditional practices in this area. If an agency were to be established in which both the Government and NGOs such as CSE could participate, the application of these practices all over the country would probably take care of our water problems in possibly the most inexpensive way, obviating the need for the proposed, extremely expensive and environment–unfriendly project of interlinking of rivers in which, unlike in the popularization of validated traditional practices, there would also be a tremendous scope for corruption, which, unfortunately, is as much a hallmark of today's India as is its scientific and industrial development.

V. Creative and cultural traditions

To give readers a flavour of the richness of the creative and cultural traditions of India, I give below a partial list of traditional endeavours that have the potential of being commercialized and raising revenue, both for the producers or keepers of such work as well as for those who create the set-up to commercialize them; in addition, the Government can also benefit through its participation in the commercialization or

through appropriate taxation. This list is based on information provided by Mr. Rajiv Sethi, Vice Chairman of the Task Force on Creative Industries set up by the Planning Commission of the Government of India. This list is only indicative and not exhaustive.

1. Handicrafts: bead and bangle making; glass blowing; carving/etching/ engraving; casting; cutwork/trellis; enamelling; filigree/wire work; footwear; furniture assembly and carpentry; glazing; inlay; lacquering/lac turnery; lapidary; moulding and shaping; paper-making; plating; embossing; setting/fixing; throwing; turning; traditional painting and frescoes; assembly skills (e.g. toy-making and bookbinding); pottery (including the disposable *kulhars* for serving drinks such as water); paper-mâché; various indigenous uses of plant material such as the making from leaves of disposable and totally hygienic *pattals* (plates) to serve food, from leaves; and cloth from parts of banana tree.
2. Textiles, clothing materials, and related activities; felt-making; spinning/ drawing of thread; weaving; cording, knotting and tasselling; dyeing, printing; embroidery/appliqué/quilting; lace work/crochet work/knitting; tailoring; costume accessories (turbans, bags, belts); traditional apparel and accessories; wool preparation and processing.
3. Household and rural community–based manufacturing: herbal preparations; utility products (chalk, incense); sericulture; honey-making.
4. Design: graphic design; intermedia design; industrial/product/commercial/ packaging design; artistic direction, scenography, museography; fashion, costume and accessories design.
5. Architecture and building arts: planning and survey; traditional architectural design and features; building services including building material; construction skills (e.g. masonry, welding and soldering); interior design; landscape design; community-based systems of transportation; sanitation; irrigation; conservation and restoration.
6. Fine arts and studio arts: painting; sculpture and installations; cartoons and caricature/calligraphy.
7. Performing and ritual arts: dance; music; theatre and dramatic arts; itinerant/ street/circus arts and entertainment; folk performances; festivals and rituals.
8. Literary arts: oral literature and storytelling.
9. Antique arts and trade.
10. Cultural education and training: libraries and archives (both private and public); museums and galleries (both private and public); cultural centres.
11. Advertising and marketing: *haats* (a place where the producer brings and sells his/her products without an intermediary) and bazaars.
12. Leisure and entertainment: traditional games and sports.
13. Food and culinary arts: vegetables, fruits, food processing; organic food (already discussed)

14 Beauty, health and healing: yoga, meditation, massage, and bone-setting; cosmetics; jewellery; martial arts.

Under each of the above categories, statistical information and identification of individuals, associations and NGOs would be needed for

a. content/idea creation and development;
b. manufacturing/production;
c. distribution and marketing; and
d. regulatory and quality protection mechanisms.

It is noteworthy that all of the above traditional arts and crafts are practised on a substantial scale in the country today, each activity involving thousands to millions of people. As examples, I mention below some impressive facts and possibilities:

- Both traditional and modern Indian paintings and sculptures have now come of age in the international market. A 9th century Chola bronze (a statue not more than 10 inches in height) is likely to fetch ten million dollars in the international market.
- Paintings of well-known Indian artists, such as Husain, routinely fetch one crore rupees each. Indian contemporary painters have never had it so good. In fact, it has now been realized all over the world that an investment in paintings done by some Indian painters who are living today or who lived in the last century may be one of the best investments that one can make today.
- As of today, it is estimated that some twenty million people may be involved in weaving cloth on handlooms or doing something on cloth by hand before marketing. There is a mind-boggling variety of weave, texture and design that identify to the discerning eye the place (including, often, the village) where the cloth was woven or processed. Such variety in textiles, which makes every piece that one wears unique for all practical purposes, is unparalleled in human history. If an Indian woman buys a handloom sari, the chance is that she will *never* meet any other women wearing the same sari. Similarly, most of us can identify paintings done by women (often utilized) of a little village in Bihar called *Madhuban*. These *Madhubani* paintings were discovered by the so-called intelligentsia of the country only a few decades ago. At that time, one could buy a good one for Rs.20 (40 U.S. cents). You cannot buy one of the same quality today for a thousand times that price. It is clearly in the country's interest to make these women go to school and become a part of the real world and yet continue to be engaged in the traditional craft that they love, which today has a tremendous market potential.

VI. Food

India has some extremely unusual vegetables and fruits - and an unparalled variety of them. Thus, there are some 150 documented vegetables for which all the nutritional information is available, and perhaps another 50 used by tribals that have not been systematically documented so far. The same is true of fruits. Many of the traditional Indian vegetables and fruits have been shown to have amazing pharmacological effects and medicinal properties as documented recently in some of the world's best-known scientific journals. It is, therefore, a matter of great concern that even our five star hotels serve no more than some 10 vegetables and very rarely fruits such as custard apple or guavas!

India has thus the potential of making an important contribution to the world vegetable and fruit market, if it could only appropriately publicize its rich heritage in

this regard. In this connection, we should recall that there was no (what we call) mineral water available in the United States or in Britain till the 1960s. It was French high-power marketing that made bottled water (beginning with Evian and Perrier) so popular in these countries, even though in all of them the water that comes through the tap is perfectly drinkable. In our country itself, we have seen how South Indian snacks have invaded the North Indian market where they were unknown till the late 1940s. There is, therefore, no reason why India should not exploit its tremendous heritage in regard to foods and vegetables and attempt to popularize them all over the world. That would be sharing of knowledge!

VII. Tourism

India, perhaps, has the potential of raising the number of tourists who visit it and, consequently, the revenue through tourism, by one order of magnitude by leveraging its creative, cultural and legacy traditions. I give below four suggestions in this regard that were arrived at during the meeting of experts, mentioned earlier, held under the auspices of the National Knowledge Commission late last year.

- Attempts must be made to empower, through information, local people to serve as guides. They could also be the custodians of India's biodiversity heritage. This would be in consonance with the provisions of the recent tribal rights bill of the Government of India (the Scheduled Tribes (Recognition of Forest Rights) Bill, 2005).
- Tribal art centres should be identified where they exist, and new ones should be opened, where possible, with competent and trained guides from the local population. It must be recognized that local people have information and anecdotes that tourists will enjoy (10–15% of India is tribal).
- Similarly, a system should be set up by which tourists are able to witness real and authentic local performing arts without adulterating them in any way. The system should ensure that the respect and dignity of the performer is fully maintained. The objective should be to share a tradition and not to make an exhibition of oneself.
- This country has some extremely unusual sites and practices, which could become major tourist attractions. For example, there is a place where birds commit suicide. Similarly, the whole process of picking raw betel-nuts from a cluster of trees that are more than 50 feet tall is absolutely stunning. This is done by a person who climbs to the top of one tree and then swings from tree to tree collecting the nuts. Such places could become major tourist attractions following the principles mentioned above. The revenue from the visit of tourists to such places should be shared with the communities involved.

VIII. Conclusions

A simple calculation indicates that traditional knowledge has tremendous potential for generating employment and income. On the basis of the population details of the 2001–2002 census and the inputs provided by the Asian Heritage Foundation, I estimate that

- Traditional knowledge and creative and cultural industries in India can provide employment for at least a hundred million persons even with a very conservative estimate –
- They have the potential to generate income to the order of Rs.400,000 crores even with a conservative estimate of the contributions from certain specific identified areas such as plant-based drugs, rainwater harvesting, marketing traditionally used fruits and vegetables, value addition to agricultural produce through organic farming and identifying new areas for tourism based on traditional knowledge.

The annexure at the end of this article provides the details of these calculations.

In conclusion, recognition of the attributes of knowledge and weaving them into the social fabric, setting up systems for disseminating and communicating knowledge that would make the country's citizens informed citizens (not only through formal education but also through non-formal means on a continuous basis) and judicious use of both new and traditional knowledge would be, in my opinion, important ingredients of a policy that would make India a knowledge-based society. It is only then that the country, which has all through history been committed to peace and has never had colonialist tendencies, will be able to renew its role as a major participant in the process of developing a peaceful and prosperous world – a world with no man-made borders.

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ANNEXURE

Traditional Knowledge, Employment and Income Potential

Employment potential of TK and creative and cultural industries in India (abbreviated collectively as TK)

(Based on 2001–2002 census)

		(Rs. in crores)
1.	**Non-workers**	
	Total 62.64 crores	
	44% (27.56 crores) can work	
	40% of 27.56 crores can work in the TK sector	11.02
2.	**Agricultural workers: cultivators**	
	(10.10 crores)*	
	20% of them can work in the TK sector	2.04
3.	**Agricultural workers: labour**	
	(12.06 crores)*	
	One sixth of them can work in the TK sector	2.01
4.	**Other workers: rural sector**	
	(10.48 crores)	
	50% of them can work in the TK sector	5.24
5.	**Other workers: urban sector**	
	(4.72 crores)	
	25% of them can work in the TK sector	1.18
		21.49

Very conservative figure: 100 million! (215 million)

(Prepared on the basis of inputs from Mr. Balasubramanian of the Asian Heritage Foundation)

II. Traditional Knowledge: Income Generation Potential per year (Pt.1)

(Rs. in crores)

•	Plant-based drugs (10 × 10,000 crores) (international market for one drug from *Phyllanthus amarus* estimated at US $ 6–18 b, say US $ 10 b $ = 45,000 crores)	100,000
•	Rainwater harvesting (100 × 100 crores) (value Rs.100 per person on an average, per year, including water for agriculture) (0.3 paise/litre based on 100 litre/person/day)	10,000
•	Preventable loss of agricultural produce owing to pests (20% lost; 75% preventable)	100,000
•	Marketing of new (traditionally used) vegetables and fruits plus value addition by food processing (target population: 1 billion @ US $30 each/year)	150,000
•	20% addition to value of 33% of our agricultural produce through organic farming	35,000
	New areas for tourism where traditional knowledge or traditional practices, cultural and creative work is exhibited (10 million tourists spending on an average $100 extra)	5,000
		400,000

Note: Value of marketed agricultural produce (approx. 20% of GDP of 600 b $ or 27,00,000 crores) — 524,000

* approximate

Concluding session

Concluding remarks

1. Prof. J.M.R.S. Bandara

I would like to stress on the involvement of universities in the validation and dissemination of traditional knowledge for endogenous development. The coexistence and acceptable coevolution of technology is possible efficiently only with the involvement of universities. However, university researchers would undoubtedly seek benefits and acceptance by the popular international refereed journals for dissemination of information, especially in the research output of postgraduate research degrees. Compas and ETC could provide access for publication in international journals, either by assisting in page charges or by expanding the existing Compas journal, LEISA, to carry an exclusive volume with research articles acceptable to the international scientific community. This would amount to generating knowledge, which is the major role of universities.

The university community should encourage a generation of new thinking in the use of indigenous knowledge for the benefit of the community that supports universities. One way of effective communication of the use of IK in today's context is to highlight the dangerous impact of modern technology which is responsible for the erosion of environment, biodiversity and human health. It would be appropriate to use more acceptable jargon in the dissemination of IK to allow space for coevolution and integration with modern technology as heritage studies or conservation of national heritage in respective countries. It is recommended that the university academic should design research proposals to create ample interest among university research students. However, popular articles in mass media would lay the foundation for such an interest.

Almost always, the common challenge presented to IK is of its inability to meet the needs and demands of the present day population, with special reference to feeding the ever increasing population. Research interest should evolve on these lines to meet the challenge of the present.

2. Mr. K.A.J. Kahandawa

Creating Enabling Policy Environment for Strengthening Traditional Knowledge Systems – The Role of Government and NGOs

What hinders the sustaining of traditional knowledge?

- Lack of knowledge among the policy makers about traditional knowledge
- The attitude of policy making bodies and individuals
- Unfriendly policies at national and international levels
- Lack of capacity of the stakeholders promoting TK level to influence policy

Stakeholders in this area of concern are

- The state
- Scientists –- modern and traditional
- NGOs and
- Communities

What are the possibilities?

At the government level

- Acceptance of a national framework on revitalization of traditional knowledge
- Identifying capacity building needs for mainstreaming identified and initiating such a programme
- At the NGO and community level
- Implementation of education and awareness raising activities
- Implementation of capacity building activities – policy lobby
- Implementation of conservation / use activities
- Development of effective relationships with scientists in the above areas

How this can be operationlized?

By influencing policy authorities:

- Documentation of experiences
- Validation and information to be presented aimed at policy level (the information can be shared from India and other countries)
- Seminars and workshops – collaborative action with other countries.

By developing a resource centre:

- Information gathering and sharing – India, Nepal etc.
- Dissemination aimed at a wider audience

Support for communities

Organizing

- Capacity building
- Resource needs addressed
- Training

Cultural programme

Later in the evening the delegates enjoyed a cultural programme. A presentation was made by Sri Santhosh Nair and his troupe. The presentation consisted of dance performances in the *Bharatanatyam*, *Mohiniyattam* and *Kuchipudi* styles.

Brief Bio-Data of Participants

Bajpai, S.

Smita Bajpai is a Bachelor of Ayurvedic Medicine and Surgery (BAMS). She is currently Programme Officer WHDRC, CHETNA, and Board Member, Dai Association, Gujarat. She has 17 years' work experience (1989 till date) at CHETNA in the area of women's health and has a gender sensitive and holistic perspective that integrates sound traditional health and healing practices. She has worked on several publications concerned with the health of women and children.

Balasubramanian, A.V.

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Coen Reijntjes was born in the Netherlands in 1948. To describe him in his own words, "I have a liberal Christian rural middle class background, and I received an academic education in land use planning and soil and water conservation at Wageningen University. My first intercultural experience I gained in the Middle East and West Africa. I worked six years in Niger and the Cape Verdian Islands in so-called integrated rural development programmes. Back in the Netherlands, I found employment with ETC Consultants for development co-operation. For ETC, I worked long time in the ILEIA programme as content editor of LEISA Magazine and during the last 3 years as editor of Compas Magazine."

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K.J.N. Gowtham Shankar is a Chairman and the Executive Director of IDEA (Integrated Development through Environmental Awakening), an organization working for tribal welfare in the North-eastern Ghats. He has been involved in documenting and reviving several indigenous resource management practices, publishing educational materials on the above subjects and conducting training programmes for tribal youth and women on endogenous development. The areas of work include agriculture, ethnoveterinary practices, nutrition and maternal and child health.

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A. Wood has a master's degree in mathematics and theoretical physics from the University of Cambridge, UK, and a doctoral degree in anthropology from the University of Chicago, USA. He is now an independent student working from home in Pune, India, on the modernization of traditional knowledge.

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